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# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 9, No. 35. WEEKLY. | NEW YORK, AUGUST 28, 1886. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.


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## The Dickson-Corliss Engine and Dickson Compound Condensing Pumping Engine.

At their three shops, the Dickson Manufacturing Company, of Scranton, Pa., are giving attention to the manufacture of several new and important specialties, two of which, recently designed by Geo. W. Watts, the company's mechanical engineer, we illustrate herewith.

The bed-plate used for the Corliss engine is of the trunk type, the guides and main shaft pedestal being cast in one piece with the frame.

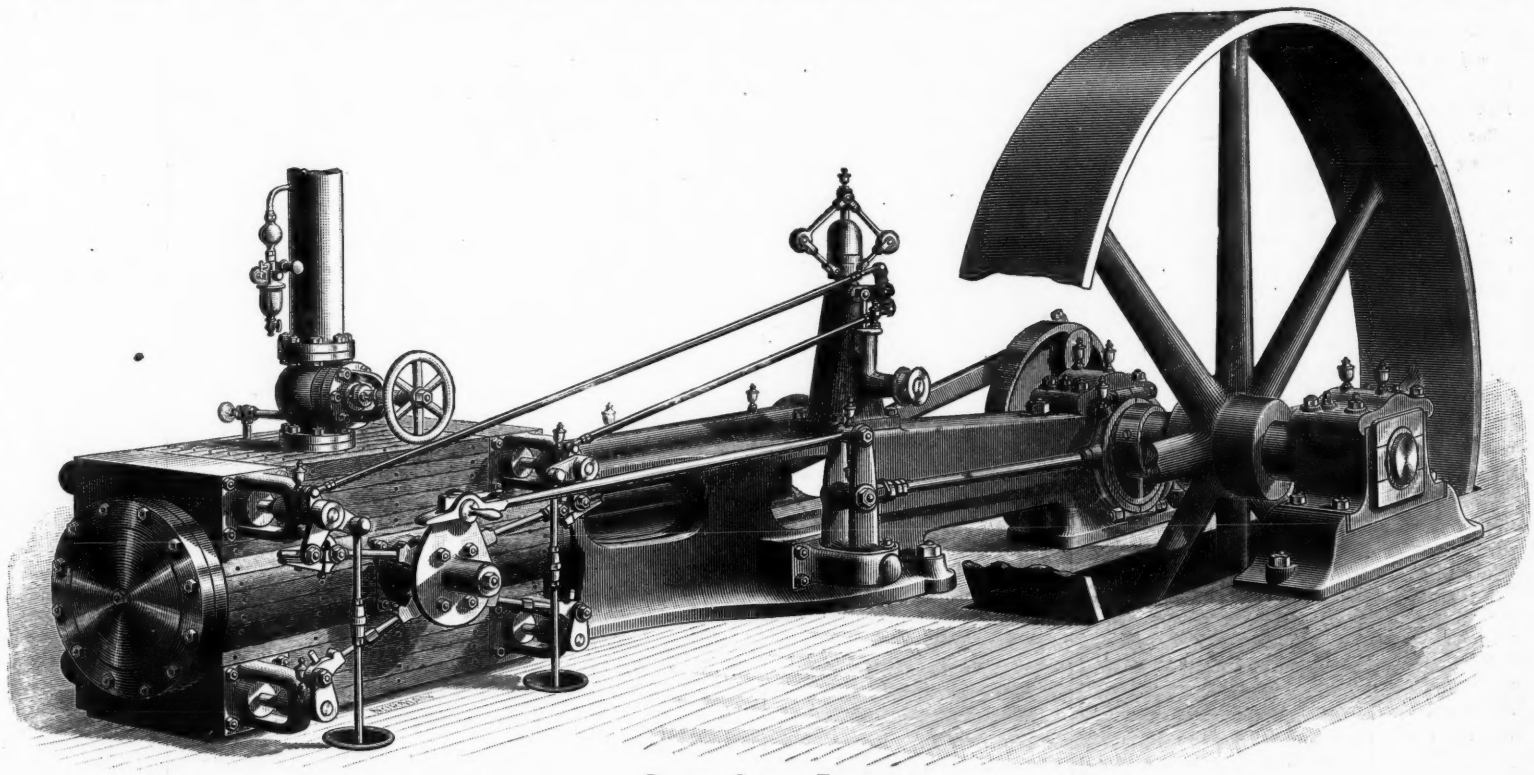
The guides are bored out, and the cylinder being bolted to the end of the frame secures perfect alignment, which from the heavy proportion of the bed, and its rigid and large bearing on the foundation, coupled with the fact that the strains are all near the foundation, is not likely to be disturbed by springing The cylinder is sustained at its inner end by the frame, and at the rear rests on a stand which provides for expansion. The main shaft pedestal has adjustable side and top boxes.

The pumping engine for water-works has been designed not only with reference to compactness, accessibility of parts and economy in the use of fuel, but also with the view of obtaining the good qualities of the vertical engine and a reduction of cost of foundation and buildings to a minimum.

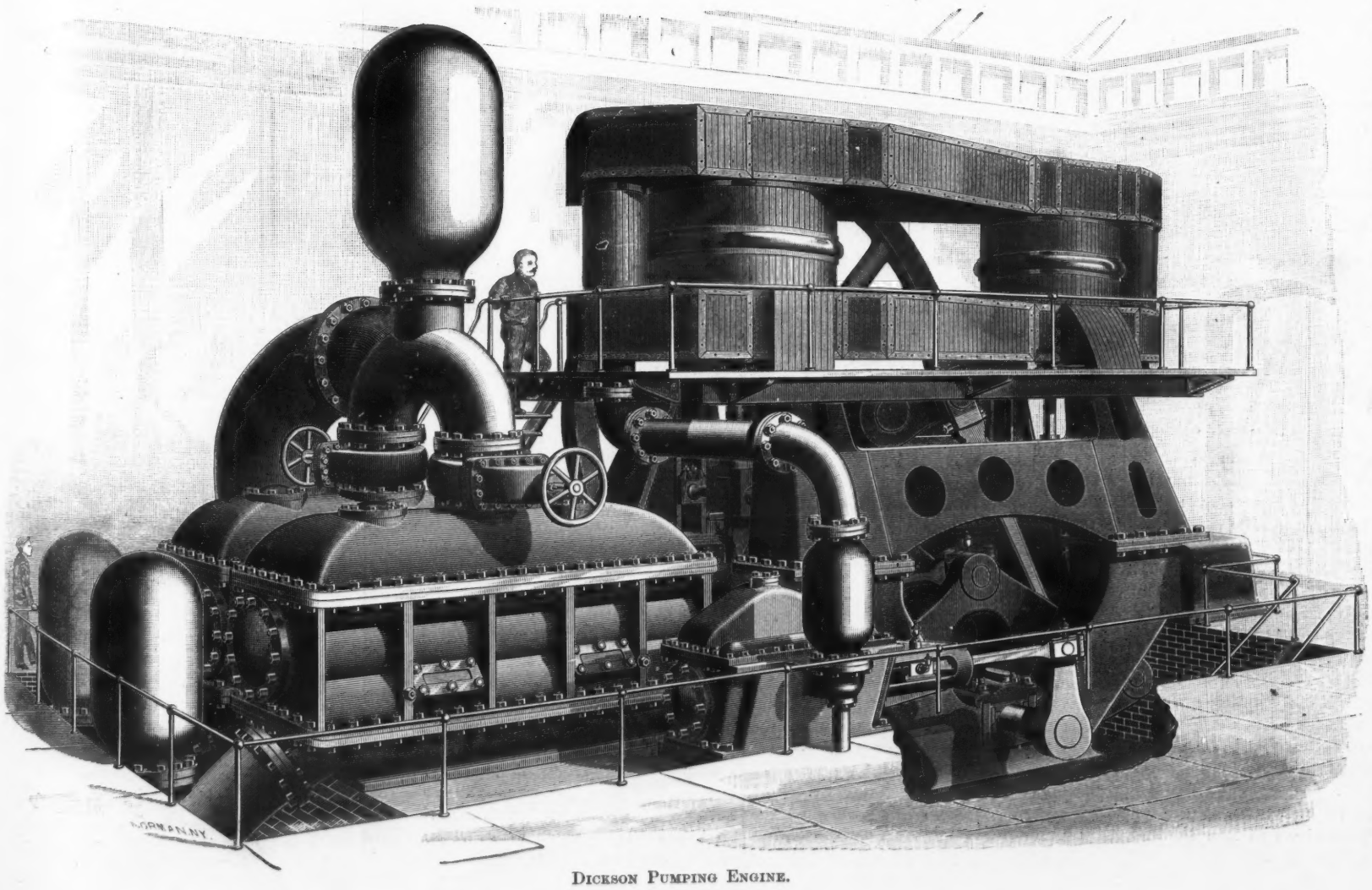
The usual objection to vertical pumping engines, viz., the cost for foundation and inaccessibility of the pumps for examination of the valves and renewal or repair of parts is mainly overcome by arranging the pump cylinders horizontally.

The two steam cylinders connect by links to a double rocking beam, the connection being at the ends and between the two beams. The two beams are practically one by being connected at the center of beams by the main beam shaft, and at the ends by pins to which the cylinders connect. Connections are made to the pumps from these beams.

The steam cylinders are steam jacketted and encased with black walnut or mahogany. Corliss valve gear or gridiron valves are used, in either case the cut-off being controlled by the governor.



DICKSON-CORLISS ENGINE.



DICKSON PUMPING ENGINE.

The condenser is of the jet type; a double-acting air-pump is used, operated by a crank-arm fixed to the outer end of beam shaft.

The pumps are fitted with double-acting plungers, and may be either inside or outside packed. Either pump may be disconnected for examination or repairs, the other meanwhile being kept at work. Thus for water works there is always reasonable assurance that one pump at least will be in working order, which averts the probability of the supply being entirely shut off.

## The Holding Power of Boiler Flues Prevents an Explosion.

During the recent meeting of the Master Mechanics, the question of the holding power of boiler tubes when beaded and unbeaded, was indirectly brought up, and as a recent case of boiler experience has quite a bearing on that point, as well as being of general interest, we give the account as it has been given to us, knowing the statement so far as the important facts are concerned, to be correct.

A new engine and boiler of modern design and best construction had recently been erected and ran with promising satisfaction for some days. The first indication of any thing being wrong was a leakage around the valve stem of the engine. It was the aim of the proprietor to run at from 80 to 100 lbs. boiler pressure, but the safety valve lever was only graduated to 90 lbs., and in order to determine the action of the engine at 100 lbs. extra weights were ordered to be placed upon it. The pressure gauge indicating but 80 lbs., and the safety valve still continuing to blow, more weights were added until the idea occurred to some one that perhaps the pressure gauge pipe was clogged. This was found to be the case, and after being cleaned out and the gauge replaced the hand immediately went around to the pin showing 150 lbs. Further investigation showed an astonishing state of affairs. The ends of the boiler above the flues had been forced out, tearing the stays loose from the head and the boiler forced out of shape in other respects, and yet the flues set in the ordinary way held the boiler head securely, even after the stays had given way.

Just what pressure was reached has not as yet been definitely determined, but the cylinder oil for which a fire test of 600° is claimed was completely burned up, and the babbitt bushing in the valve rod stuffing-box was absolutely melted by the heat of the steam in the steam chest. It is proposed to ascertain if possible the melting point of this same piece of babbitt metal and so determine the actual pressure.

No doubt various opinions will be expressed in regard to this in many ways; prominently as to whether it was a good or bad boiler. Some may say it proved to be weak in the staying. We do not see that this is necessarily so, for possibly the holding power of the flues was greatly in excess of what was required and the shell might have been on the point of rupture when the stays gave way. Everybody will be ready to say they all must have been a pack of fools, but as a matter of fact they are nothing of the kind, and we are led to believe it all comes from what is often considered to be a good trait in an employe—that spirit which carries out what he understands to be the order, without regard to consequences.

## Traction and Adhesion.

BY A. B. ROPES.

Considering the number and extent of the researches that have been made on the twin subjects which head this article, it seems strange that so much doubt should still exist as to the amount of friction between a driving wheel and a dry rail. Go into almost any roundhouse, and you may find by conversation with the runners that a large (*i. e.* too large) proportion of the engines are "slippey," and although every day broken pins and side-rods, flat tires and worn rails swell the bills for "repairs," the same-sized cylinders are put to work on drivers bearing the same weight, and with the exception of the men who are obliged to climb hills with these engines, holding the throttle lever in one hand and sand lever in the other, no one notices this serious defect in design, or experiments with a view of remedying it.

We do, it is true, see once in a while an engine carrying around half or three-quarters of a ton of extra metal in the shape of a heavy deck-plate or cast-iron cab, and once in a while a "traction increaser" kindly relieves the tender of a portion of its load for the benefit of the engine, probably on the principle that "Whoso hath to him shall be given." These means are all endeavors to atone for a faulty design, and could many realize how easily the proper weight for the drivers, under ordinary conditions for any given size of cylinders, could be fixed on, there would be less work for the wheel lathes.

In order to examine the subject fully, let us first see what traction is; then examine the methods of finding the power exerted on the wheels by the pressure of the steam in the cylinders. And finally I shall give some examples from actual practice that have come under my own observation, and explain a simple method by which master mechanics may, at a very slight expense, find for themselves the power exerted by their engines in hauling their trains, and proportion the loads on the drivers so that sliding and slipping will be reduced to a minimum.

First, What is the tractive power of an engine? The tractive power is its hauling power, or the power by which it is forced in a horizontal direction along the rails, and depends not only on the size of its cylinders, but also on the amount of adhesion of the driving wheels to the rails. As an engine is only as strong as its weakest part, if the wheels slip before the maximum power of the cylinders can be exerted, the excess of cylinder capacity does no more good than if it were not on the engine. Indeed, it is a great disadvantage, as the engine, when working at the longer points of cut-off, must do so on a partially closed throttle; and these points are the very ones where a full throttle opening is imperatively demanded. In the modern locomotive the pressure of the steam on the pistons is communicated by means of rods to the wheels directly. Therefore, friction aside, the work done by the steam in the cylinders must be "given out," we may say, at the circumferences of the driving wheels. As work, mechanically speaking, is the product of a resistance and the distance through which the resistance is overcome, we may ascertain the amount of work done in the cylinders of any engine during one revolution of the drivers by multiplying the pressure required to move the pistons by the distance through which the pistons move in one revolution of the wheels, or four times the length of the stroke.

This amount of work will be exerted at the circumferences of drivers on the rail, and will urge the engine in a horizontal direction along the track, if the wheels don't slip. Since, for any particular case, we wish to know not only the amount of work during one revolution, but also the tractive force which the drivers are exerting on the rail, we may ascertain the latter by remembering that the work done by the steam on the pistons is the same (friction aside) as that done by the drivers on the rail. To make this clear, we may state it in this form:

$$\text{Work done in cylinders in one revolution} = \begin{cases}\text{Pressure on pistons} \times \text{distance traveled by pistons.}\end{cases}$$

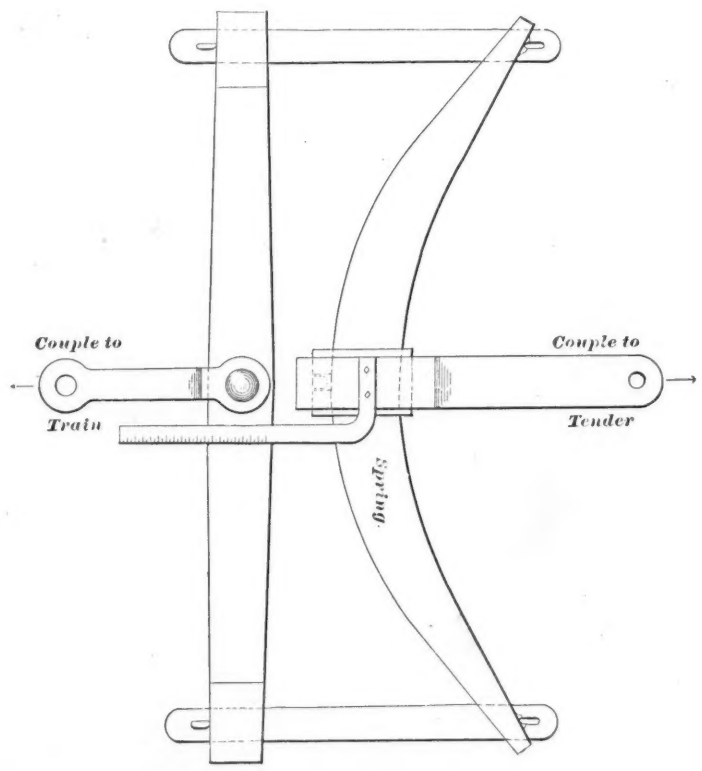
which is always equal to

$$\text{Work done by drivers in one revolution} = \begin{cases}\text{Resistance to motion of drivers} \times \text{distance traveled over by driver in 1 rev'l'n.}\end{cases}$$

This once understood, we may easily determine the resistance to motion of drivers (which, if the drivers overcome it, will be the tractive force), by dividing the work done in cylinders in one revolution by the distance moved over by drivers in one revolution. This distance is the circumference of the wheel.

Let us apply our rule: Take an engine with cylinders of 17″ bore, 24″ stroke, and drivers 62″ diameter. The area of a piston will be $17 \times 17 \times 7854 = 226{,}981$ sq. in. To get the pressure on a piston, we multiply this product by the mean effective pressure in the cylinder during the stroke. If the steam admitted to the cylinder has a pressure of 135 pounds per square inch, and the valve closes after the piston has moved 21 inches, the mean pressure in the cylinder will be about 127 pounds per square inch of the piston; and since there are 226,981 square inches of surface in the face of a piston the pressure on that face will be $226.981 \times 127 = 28826.587$ on an average throughout the stroke.

This force is exerted through $24 \times 4 = 96$ inches during one revolution of the wheels,




TRACTION DYNAMOMETER.

so the pressure by the distance through which it is exerted, or $28826.587 \times 96 = 2767352.352$ equals the number of inch-pounds of work done in the cylinders during one revolution of the drivers. This work is done and also given out during one revolution of the drivers. The circumference of a 62″ wheel equals $62 \times 3.1416 = 194.779$ inches, and the resistance to motion or the tractive force, as we have seen, will be equal to the work done in one revolution divided by the circumference of the wheel, or $2767352.352 \div 194.779 = 14207.652$ lbs.

Let us now compare this tractive power with the figures given by other experimenters for the adhesion of a driver to a dry rail.

On looking over the results of past experiments made by different authorities, we find it difficult to choose a result which we may be sure is nearly right for the use to which we would put it. We wish to load our drivers so that they will not slip when a force to overcome a resistance of 14207.652 pounds at the circumference is applied, and yet we are sure that less weight is needed than would seem to be indicated as necessary by the results of some of the experiments. For instance, Poiree, a French experimenter, states that the wheels will just commence to slide at a speed of ten miles per hour if for every ton (of 2240 lbs.) of load on the wheels a force of 465.9 lbs. be applied to the circumference, while Westinghouse and Galton give as the results of their experiments under similar conditions 246.4 lbs. per ton as being sufficient to slip the wheels. Recent experiments conducted by the experimental department of the Pennsylvania Railroad indicate a much higher coefficient of friction than has yet been supposed to exist, rising, in some cases, as high as 550 lbs. per ton of load, and, as we shall see, these figures are more nearly correct than the former ones.

I will now give a few figures from actual practice as observed while riding on engines hauling heavy trains over the Northern Pacific Railroad, and show that the figures of Poiree and Westinghouse are, for some cases at least, much too low, and then by means of experiment and comparison of results, we will try to establish a percentage of load for our drivers, which while not excessive will decrease the slipping.

These observations were made on the performance of an eight-wheeled engine of the "American" type. Cylinders 17″ diameter, 24″ stroke, drivers 62″ diameter. Weight of engine loaded, 77,800 lbs. Weight on drivers, 49,700 lbs. According to the figures of Poiree, which exceed those of Westinghouse, a resistance of 10,333 lbs. would cause the wheels to slip, whereas this engine actually took a train which, on a straight track, offered a resistance of 12,190 lbs. up a grade of 40 feet to the mile and around a sharp reverse curve, with the rails wet with dew (time about 5.30 A. M.) and only slipped once—this being on the curve mentioned above, and the slipping was instantly stopped by the application of a little sand to the rails. On the curve the resistance must have increased to 15,000 lbs., which would give for the amount required to slip the drivers 670 lbs. and over, per ton of load. Laying supposition aside and taking the resistance of the train on a level track, which we know to be 12,190 lbs. we see that the load on the drivers was 22.18 tons of 2240 lbs. per ton, and that with these 22.18 tons of load the engine overcame the above resistance, therefore it must at least have required

$$\frac{12{,}190}{22.18} = 545 \text{ lbs.}$$

per ton of load to pull the train, and it did this easily without slipping.

At a future date, if desired, I will add the results of some experiments made with the indicator as a check on the other results, but at present I will be content with suggesting a simple form of traction dynamometer which any master mechanic can rig up for himself in odd moments (if master mechanics have any odd moments), and may find of great service and surprising accuracy, considering the simplicity of design as compared with the expensive and elaborate dynamometer cars, which are fitted up at a cost of thousands of dollars for the purpose of solving such problems as are presented here. The apparatus referred to consists of a driving or other convenient spring having attached to it a graduated metal scale. The amount of deflection of the spring can be measured on any grade and with any weight of train, and the greatest power which the cylinders can exert as well as the resistance at which the drivers begin to slip, can be noted, and the weights on the drivers regulated accordingly.

Do not, however, be content with reading this explanation of the apparatus. Make one, use it. It was from a fear that farther experiments would not be made that I have withheld figures obtained by myself. We are too likely in this age of experiment to accept results of some one's else experiments instead of troubling ourselves to add to the data.

Finally when we find the right lead for our drivers let us apply it. Not in the form of a traction increaser or a heavy sand-box cover or dome-casing, but in boiler space. It is here that so many American engines are deficient. It is here that so much fuel goes to waste by endeavoring to keep a pressure of 140 pounds for cylinders that open their huge capacities to be filled with steam four times every revolution.

I hope that this paper may serve as an inducement to farther experiments on the subjects which have been touched on, and that I as well as others may be benefited by the results of experiments so made.

## Laying out the Partition and Seat for a Globe Valve Core-Box.

BY F. W. BARROWS.

There will probably be no question but what the nicest way to cut the elliptic hole through the angular partition in a globe valve is to chuck the piece to form the partition in the lathe at the right angle, and then bore the hole either straight or on a taper as the design may call for. While this is entirely practical in the case of ordinary sized valves, with the help of a slide rest lathe, it would not be so in the case of very large valves in a lathe not provided with a slide rest. Therefore some other method becomes necessary. This has led me to put the method shown into practical form, for while there is nothing new in the principle involved, still there may be some who are bothered to apply this well-known principle to this problem, and for these few I have tried to make it plain.

Let the great circle *a b c* be the line showing size of body of core, the lines *d f* and *e g* showing the angular partition. The line *k j* is the outside diameter of loose seat, which in this case is to be straight. The angular partition is to be cut through parallel with center line *C D*. The best way will be to make a templet for one-quarter of the hole, as follows:

From the point where the line *C D* is intersected by the line *e g*, which represents one side of partition, draw a line 1, 9 at right angles with *C D*, then draw the quarter circle *x*9 with a radius equal to outside diameter of loose seat. Now space off this quarter circle into equal parts, the more the better, and from each space draw lines parallel with *C D* as 1, 2, 3, 4, 5, 6, 7, 8, carrying these lines up to line *e g*, and from the points of intersection draw other lines perpendicular to *e g*, as 1*c* 2*c* 3*c* 4*c*, etc. Now with the dividers transfer the space between 1 and 1*a* to line from 1 to 1*c*, then the space between 2 and 2*a* to line drawn from *e g* to 2*c*; transfer the length of each line in turn, measuring from the line 1, 9 to quarter circle *x*9, then transferring the space thus found to corresponding line drawn perpendicular to *e g* and measuring from *e g*. After transferring all the spaces, if we connect the points 1*c* 2*c* 3*c* 4*c*, etc., we shall have a broken line, which will approximate the elliptic curve required, and if we would divide the quarter circle *x*9 into an infinite number of parts, and then transfer these spaces thus formed to lines perpendicular to *e g*, we should get the curve perfect.

The departure from the perfect curve is not owing to any error in the principle involved, but is due to inaccuracy in the application. Still, this curve may be laid out by a close workman as nearly perfect as it is possible to work by hand in wood.

Now, make a template from line *e g* to 1*c* 2*c* 3*c*, etc., and draw the center line *A B*. You can then mark off both sides of each half of partition, for you will want a right and left where the partition is bored parallel to *C D*. I think this is the best way to cut partitions, as it leaves the loose part in better shape. The shape of pieces forming the angular partitions is shown by shaded portion *o*. The other half of same side of partition would be bounded by the broken curved line *y*.

Now, if we wish to cut the partition parallel with line *A B*, so that the one piece may be used for making both halves of the core, mark the center line *A B* on templet; then, by marking the same center line across the piece for partition, and laying on the templet so that these center lines will coincide, the hole through partition may be marked off, and the outside of partition will be cut on curved line *s r*.

In case the loose part of seat is to be tapered, as shown by section *n*, draw the line *h i* corresponding with outside diameter of loose pieces; then draw other lines perpendicular to *C D*, and passing through the points where lines 1, 2, 3, 4 intersect *e g*, carrying them out to line *h i*. These lines are shown, as 2*g* 3*g* 4*g*, etc.

Set the dividers from center 1 on line 1.9, to the point intersected by line *h i*; transfer this space to line 1*D*, as from 1 to 1*b*. Set the dividers again at 2*g*, and take the space on this line between *C D* and *h i*; move one leg of dividers to center 1; then, with the other leg, mark across line 2, as at 2*b*, making the distance between center 1 and point 2*b*, measured on a straight line, equal to distance on line 2*g* between *C D* and line *h i*. Proceed in like manner until all of the spaces have been transferred from lines 2*g* 3*g* 4*g*, etc., to imaginary lines between center 1 and points 2*b* 3*b* 4*b*, etc.

Now, setting the dividers again at center 1, and measuring on line *C D* to point 1*b*, transfer this space to line from 1 to 1*d*, perpendicular to line *e g*. Again, transfer the space between 2 and 2*b* from line *e g* to 2*d*. Transfer all the spaces between 2, 3, 4, 5 and 2*b* 3*b* 4*b* 5*b* to lines perpendicular to *e g*, as at 2*d* 3*d* 4*d* 5*d*; then, by joining these new points, we get the curve, shown by line 1*d* 2*d* 3*d*, etc., necessary to fit the tapered circular partition, shown in section at *n*.

We still have the loose pieces to cut off to line of angular partition. Make these pieces, when turned up, long enough to reach through angular partition, as shown by line *m l*. The circumference of these pieces will then be represented by quarter circle x 9. Then space off the edge *m l* of loose piece to agree with the spaces 1*a* 2*a* 3*a*, etc.; lay the piece on a surface plate with side *m l* down, and with a right angle square lines up from these points, and number them to correspond with numbers 1*a* 2*a* 3*a*, etc. Now carry the lines 1, 2, 3, 4 up to *m l*, as at 4*e* 5*e*, etc.; then, by transferring the spaces on lines 1, 2, 3, 4 between lines *m l* and *d f*, as from 4*e* to 4*f* and 5*e* to 5*f*, to corresponding lines on outside of loose piece. The points thus found will all lie in the plane formed by one side of the angular partition, and shown in the figure by line *d f*.

To cut off the corner *w*, which projects beyond the circle *a b c*, lay the piece on a surface plate with the side shown in figure down, having first marked the line of great circle across the edge. Then with a templet which has one straight side to lay on surface plate, and the other sides bounded by a circle equal to *a b c* having its center on straight side, we can make a line which will show just how much to cut off this corner by laying the templet against the already beveled side of loose piece, and drawing a line around the circular edge of templet passing through the point already located on the edge of loose piece by circle *a b c*.

There is still one more point to explain in case the angular partition is cut through parallel with *A B*, as it will then be necessary to cut off the corner of loose piece all the way around. After cutting the angular partition and also cutting the loose piece to line *d f*, place the piece on a surface plate in the position occupied when marked off corner *w*. Then by placing the templet used in laying out hole through angular partition against the beveled side of loose piece making the point at *w* coincide with the line of circle *a b c* on loose piece, draw a line around the curved side of templet. Now gauge off on the outside of loose piece the thickness of partition *o*. These two lines show just how much will have to be cut off from loose piece.

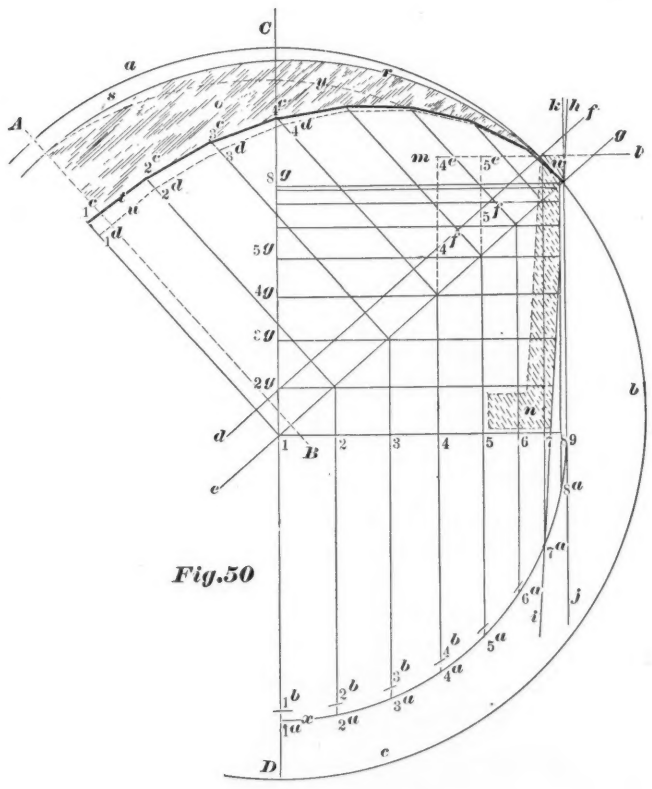



*Fig.50*

LAYING OUT CORE BOX.

## Inoxidisable Surfaces for Iron.

There are many methods, technically known as "bronzing," for rendering the surface of iron inoxidizable, but they are confined to certain trades, such, for instance, as gunmaking, and the engineer knows but little of them. He has neither the time nor the patience to carry out the ten or twenty alternate rustings and polishings which are required to get a good bronzed surface. If he has to expose bright work to the weather, his only resources are constant greasing and rubbing, or the paint brush. In the case where the metal is black, he has a little more scope, and can employ either galvanizing or the Bower-Barff process, and cover the object with a protective skin of either zinc or magnetic oxide of iron. A new method, which promises to be easier of application than any of the previous, has, however, been lately brought out by M. A. de Meritens, the well-known electrician; and if it succeeds as well in the hands of the public as it does with the inventor, should find a very extended application. The article to be protected is placed in a bath of ordinary or distilled water, at a temperature of from 70 degrees to 80 degrees Centigrade (158 degrees to 176 degrees Fahr.), and an electric current is sent through. The water is decomposed into its elements, oxygen and hydrogen, and the oxygen is deposited on the metal, while the hydrogen appears at the other pole, which may either be the tank in which the operation is conducted, or a plate of carbon or metal. The current has only sufficient electromotive force to overcome the resistance of the circuit and to decompose the water; for if it be stronger than this, the oxygen combines with the iron to produce a pulverulent oxide, which has no adherence. If the conditions are as they should be, it is only a few minutes after the oxygen appears at the metal, before the darkening of the surface shows that the gas has united with the iron to form the magnetic oxide $Fe^3 O^4$, which it is well known will resist the action of the air and protect the metal beneath it. After the action has continued an hour or two, the coating is sufficiently solid to resist the scratch brush, and it will then take a brilliant polish. The depth of penetration is shown by the following fact. A gun barrel was oxidized, and then the magnetic coating was completely removed by emery, until the surface again became white. It was again returned to the bath, and immediately, on the passage of the current, the black color again reappeared. If a piece of thickly rusted iron be placed in the bath, its sesquioxide ($Fe^2 O^3$) is rapidly transformed into the magnetic oxide. This outer layer has no adhesion, but beneath it there will be found a coating which is actually a part of the metal itself.

In the early experiments with this process M. de Meritens employed pieces of steel only. But when he turned to objects in wrought and cast iron he found that he no longer was successful, for the coating was not fast, and came off with the slightest friction. After many trials with currents of different electromotive force, he reversed the order of affairs, and placed the iron at the negative pole of the apparatus, after it had been already applied to the positive pole. Here the oxide was reduced, and hydrogen was accumulated in the pores of the metal. The specimens were then returned to the anode, when it was found that the oxide appeared quite readily and was very solid. But the result was not quite perfect, and it was not until the bath was filled with distilled water, in place of that from the public supply, that a perfectly satisfactory result was attained.

The process, it will be seen, is perfectly simple, and demands but little skill in its execution. Now that dynamo machines have superseded batteries as sources of electricity, all that is required is a tank, a quantity of distilled water, and a little power to drive the machine. By placing a number of baths in series, and increasing or diminishing their number, the electromotive force of the current can be regulated without any arrangements of artificial resistances. We expect that many manufacturers will give this process a trial.—*Engineering.*

## The Big Raft.

The big lumber raft at Halifax, N. S., seems destined to bad luck. Two unsuccessful attempts have been made to launch the raft, during one of which the cradle became wrecked, and the raft grounded.

Considering the extreme height of Nova Scotia tides, the question arises regarding the soundness of the engineering methods adopted by builders of the big raft. A temporary tide-gate at the mouth of a creek or small river would enable the raft to be built in comfort, and floated at will, without the construction of the expensive cradle on ways.

## Uniform Railroad Signals.

In speaking of a recent convention of railroad agents in Cleveland, Robert Pitcairn, according to the Pittsburgh *Gazette*, says:

"The meeting at Cleveland this week was another of a series that our committee has been holding. We have before us the rules governing the movement of trains from all countries in the world, and from the mass of matter we hope to evolve a system of rules that will answer the purposes of civilization. As it now is a green light on a train on one road doesn't mean what it would on a train on another road.

"A lantern swung back and forward on one road would back a train, while on another it would start it forward. A man coming from the Baltimore & Ohio road to work for the Pennsylvania railroad has to learn the signals and manner of running trains, and knowing both is apt to get confused and consequently to cause confusion and not infrequently destruction. What we are trying to do, in a word, is to formulate a series of rules for locomotion that will be national in character. We want to have it that a man leaving the Pennsylvania road may go to work on the Mexican Central or the Southern Pacific without embarrassment to himself or the company hiring him. We have settled the matter of time in this country so that railroads can operate without confusion. This committee was appointed by the same convention, and is another movement toward simplifying and making uniform the locomotion rules of the country."

## Modern Locomotive Construction.

BY J. G. A. MEYER.

TWENTY-FIFTH PAPER.

HOW TO LAY OUT THE DOME SHEET WHEN THE DOME IS TO BE PLACED ON THE TAPERED COURSE, AS SHOWN IN FIGS. 134 AND 136.

Diameter of dome to be 28 inches, thickness of metal $\frac{3}{8}$ of an inch, height of dome measured on the line $d_5\ e_5$, Fig. 136 is to be 26 inches, lap $2\frac{1}{2}$ inches, and the center of the vertical lap to be on the line $d_1\ e_1$.

At first sight it may seem to be a difficult matter to lay out a sheet of this kind, but yet, although a little more labor is required to do this, than that needed in the former examples because in this case three views are required instead of two, it will be found to be not such a difficult task as it first appears. First, draw the tapered course, as shown in Fig. 136. The line $l\ o$ represents the center line of the barrel of the boiler, $g_5\ l$ and $h\ o$ the center line of rivets, hence the lines $g_5\ l$ and $h\ o$ must be perpendicular to the center line $l\ o$. Draw the center line $d_1\ e_1$ in the desired position, and perpendicular to $l\ o$. The distance between the lines $d_5\ e_5$ and $d_{13}\ e_{13}$ must be equal to the diameter of the dome less the thickness of the metal, hence we have $28'' - \frac{3}{8}'' = 27\frac{5}{8}''$ which will be the distance between these lines. Therefore on one side of the center line $d_1\ e_1$ and $13\frac{13}{16}$ inches away from it, draw the line $d_5\ e_5$ parallel to $d_1\ e_1$; care must be taken in laying off to measure the $13\frac{13}{16}$ inches on a line perpendicular to $d_1\ e_1$, such as $l\ o$ for instance, and not on the line $g_5\ h_5$. On the other side of $d_1\ e_1$, $13\frac{13}{16}$ inches away from it, and parallel to it, draw the line $d_{13}\ e_{13}$. The lines $d_5\ e_5$ and $d_{13}\ e_{13}$ will intersect the line $g_5\ h_5$ in the points $e_5$ and $e_{13}$. On the line $d_5\ e_5$ lay off a point $d_5$ 26 inches from the point $e_5$; this distance between the points $e_5$ and $d_5$ will represent the height of the dome. Through the point $d_5$ draw a straight line $d_5\ d_{13}$ perpendicular to $d_1\ e_1$, this line will represent the top of the dome. Produce this line towards Fig. 134. At any convenient distance draw the line $x\ y$ parallel to $d_1\ e_1$. From any point $A_5$ as a center on the line $x\ y$ draw a circle $27\frac{5}{8}$ inches in diameter, Fig. 135; draw the diameter from 1 to 9 perpendicular to $x\ y$.

On the line $x\ y$, Fig. 134, lay off a point $f_5$ whose distance from the line $C_3\ C_4$ will be equal to the height $l\ g_5$, Fig. 136. Through the point $f_5$ and from a point as a center on the line $x\ y$ draw an arc whose radius will be equal to that of the outer crown sheet. Again on the line $x\ y$ lay off a point $i_5$, the height of this point above the line $C_3\ C_4$ must be equal to $o\ h_5$, in Fig. 136; through the point $i_5$ and from a point as a center on the line $x\ y$, and with a radius equal to that of the outer crown sheet draw an arc. Through the point 1, in Fig. 135, draw towards $C_3\ C_4$, in Fig. 134, a straight line parallel to $x\ y$, and also through the point 9, in Fig. 135, draw towards $C_3 C_4$ another straight line parallel to $x\ y$; these lines will intersect the line $b_9\ d_{13}$ in the points $b_1$ and $b_9$; the line between the points $b_1$ and $b_9$ will represent the top of the dome in Fig. 134. Divide the circumference of the circle, in Fig. 135, into any even number of equal parts, say 16, and in a manner as shown. Through these points of division and towards the outer crown sheet, in Fig. 134, draw straight lines parallel to $x\ y$. These lines will intersect the line $b_1\ b_9$ in the points $b_2\ b_3\ b_4$, etc., the portions of these lines lying between the points $b_2\ b_3\ b_4$, etc., and some particular points, not yet found, in the surface of the outer crown sheet are auxiliary lines assumed to be drawn on the outside of the dome; but before these auxiliary lines are of any practical value, we must find the length of each of these lines, or, in other words, we must find the points in which these auxiliaries will pierce the surface of the outer crown sheet, which are the particular points in the surface of the outer crown sheet just alluded to.

Right here we will call particular attention to the positions of the auxiliary lines as shown in Figs. 134 and 136. Take for instance the point 5, in Fig. 135, and the point $b_5$, in Fig. 134, these points represent one and the same point, and since the point 5 divides the semi-circumference into two equal parts, it follows that the point $b_5$ must also divide the line $b_1\ b_9$, (which represents the same thing as the circumference of the circle in Fig. 135, namely, the top of the dome) into two equal parts, and, therefore, the auxiliary line drawn through the point $b_5$ will appear to occupy a central position on the dome as shown in Fig. 134. But not so in Fig. 136; here the point $d_5$ represents the same point as that marked 5, in Fig. 135, or, in other words, the point marked 5, in Fig. 135, and that marked $b_5$, in Fig. 134, and also $d_5$, in Fig. 136, all represent one and the same point. Now since point 5, in Fig. 135, occupies an extreme position, or, as we may say, since the point 5 lies outside of all the other points, such as 4, 3, 2, etc., when we look at the dome in a direction as indicated by arrow $W$, it follows that the point $d_5$, in Fig. 136, must also occupy an extreme position, and an auxiliary line drawn through this point, such as $d_5\ e_5$, must lie outside of all the other auxiliary lines that can be drawn on the dome, when we look at the dome in a direction as indicated by the arrow $W$, Fig. 135. Here, then, we see that the line $b_5\ c_5$, in Fig. 134, and the line $d_5\ e_5$, in Fig. 136, represent one and the same auxiliary line, and that in Fig. 134 this auxiliary appears to occupy a central position on the dome, because we are looking at the dome in a direction as indicated by the arrow $W_2$, and in Fig. 136 this same auxiliary line appears to occupy an extreme position because we are looking at the dome in the direction as indicated by the arrow $W$.

Again take the point 13, in Fig. 135, and assume that we are looking at the dome in the direction as indicated by the arrow $W_2$, then this point, in Fig. 134, will be concealed by the point $b_5$; hence, we may justly say that the point $b_5$ represents two points, namely, those marked 5 and 13, in Fig. 135. But looking at the dome in the direction as indicated by the arrow $W$ the point 13 will appear to occupy an extreme outside position, that is, it will appear to lie outside of all the other points, such as 14, 15, 16, etc., and, therefore, the point $d_{13}$, in Fig. 136, which represents the same point as that marked 13, in Fig. 135, must also occupy an extreme position, and an auxiliary line drawn through the point $d_{13}$ must lie outside of all other auxiliary lines that can be drawn on the dome when we are looking at it in a direction as indicated by the arrow $W$. From this we learn that auxiliary lines supposed to be drawn through the points marked 5 and 13, in Fig. 135, will be represented by only one line, in Fig. 134, because one line is concealed by the other, whereas in Fig. 136 both of these auxiliary lines can be seen, and each will appear to occupy an extreme position on the dome; in fact these lines form part of the outline of the dome in this figure. Once more: take the point 4, Fig. 135, and the point $b_4$ in Fig. 134, these points represent one and the same point, and an auxiliary line supposed to be drawn through this point will be represented by the line $b_4\ c_4$, in Fig. 134, and by the line $d_4\ e_4$ in Fig 136. In the former figure the line $b_4\ c_4$ occupies a position next to the center line $b_5\ c_5$, because we are looking at the dome in the direction indicated by the arrow $W_2$, and in the latter figure the same auxiliary, as represented by the line $b_5\ c_5$, appears to occupy a position next to the outer line $d_5\ e_5$, because in this figure we are looking at the dome in a direction as indicated by the arrow $W$. But the line $b_4\ c_4$, in Fig. 134, will conceal the line assumed to be drawn through the point marked 14, in Fig. 135, and looking at the dome in the direction as indicated by the arrow $W$ we can see both lines drawn through these points as represented by the lines $d_4\ e_4$, and $d_{14}\ e_{14}$ in Fig. 136; hence auxiliary lines, supposed to be drawn through the points, marked 4 and 14 in Fig. 135, are represented by one line $b_4\ c_4$ in Fig. 134, and in Fig. 136 the lines drawn through these points are shown by the lines $d_4\ e_4$ and $d_{14}\ e_{14}$. In a similar manner, it can be shown that each of the auxiliary lines, except the lines $b_1\ c_1$ and $b_9\ c_9$ in Fig. 134, will represent two lines, because each line will conceal another. But the same remarks apply to the auxiliary lines in Fig. 136; here, also, each of the auxiliary lines, except the line $d_5\ e_5$ and $d_{13}\ e_{13}$, will represent two lines. It will be remembered that this figure shows how the auxiliary lines on the dome will appear when we are looking at it in the direction as indicated by the arrow $W$; hence the line $d_1\ e_1$, for instance, will represent the lines assumed to be drawn through the points marked 1 and 9 in Fig. 135, and the line $d_2\ e_2$ will represent the lines assumed to be drawn through the points 2 and 8, and so on. These remarks the student should keep well in mind, as these will make the following construction appear plainer: In this construction similar figures, attached to any letter in the different views, always indicate one and the same point or line. How to find the positions of the auxiliary lines in Fig. 134 (but not their lengths) has already been explained, and the positions of the auxiliary lines in Fig. 136 can be found in the following manner: From the point $d_1$, which is the center of the line $d_5\ d_{13}$, lay off a point $d_4$; the distance between these points must be equal to that between $A_4$ and 4, in Fig. 135. Again, from the point $d_1$ lay off a point $d_2$; the distance between these points must be equal to that between the points $A_3$ and 3, and in a similar manner the points $d_2\ d_{12}\ d_{13}$, etc., are found. Through these points draw straight lines parallel to $d_1\ e_1$, and thus obtaining the positions of the auxiliary lines. But now notice that the distances between the auxiliary lines in Fig. 136 and those between the auxiliary lines in Fig. 134 are alike each to each; this is because each quarter of the circumference of the circle in Fig. 135 has been divided into an equal number of equal parts; therefore, to find the positions of the auxiliary lines in Fig. 136, we might have said, Draw the auxiliary lines in Fig. 136 in similar positions as those shown in Fig. 134.

Fig. 139

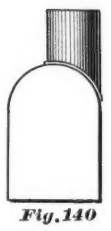


Fig. 140

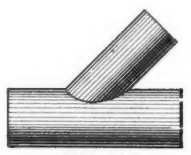


Fig. 141

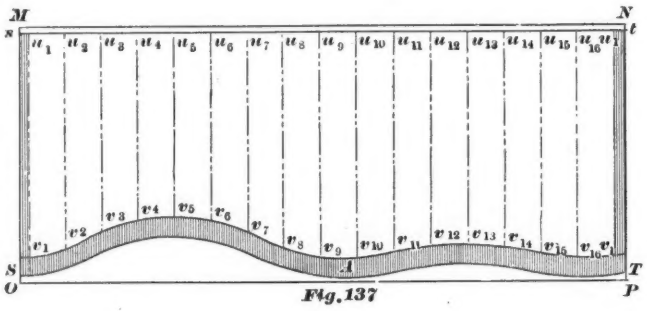



Fig. 137

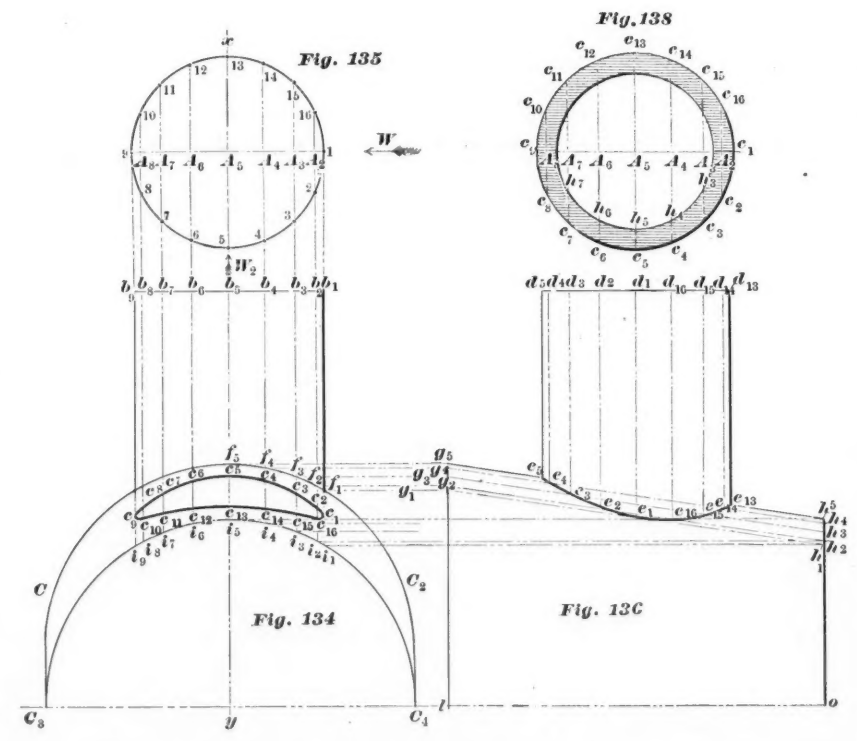



Fig. 138

HOW TO FIND THE POINTS IN WHICH THE AUXILIARY LINES WILL PIERCE THE SURFACE OF THE OUTER CROWN SHEET.

In Fig. 134 we notice that the auxiliary line drawn through the point $b_5$, and also a line assumed to be drawn from the point $f_5$ to the point $i_5$ on the outer crown sheet, will lie in the same plane.* But in Fig. 136 the line $g_5\ h_5$ represents the line $f_5\ i_5$, shown in Fig. 134, and the line $d_5\ e_5$ represents the line $b_5\ e_5$. Now, the line $d_5\ e_5$ intersects the line $g_5\ h_5$ in the point $e_5$ and, since both these lines lie in the same plane, we conclude that the point $e_5$ is the point in which the auxiliary line $d_5\ e_5$ pierces the outer surface of the crown sheet, and consequently the distance between the points $e_5$ and $d_5$ will be the length of this particular auxiliary line. The line $d_{13}\ e_{13}$ and the line $g_5\ h_5$ also lie in the same plane, and therefore the point of intersection $e_{13}$ will be the point in which the line $d_{13}\ e_{13}$ pierces the surface of the outer crown sheet, and the distance between the points $d_{13}$ and $e_{13}$ will be the length of this auxiliary line. Again, let us assnme that in Fig. 134 another line, $f_4\ i_4$ is, drawn, the surface of the outer crown sheet being parallel to $f_5\ i_5$, and that the distance between these two lines is equal to that between the points $A_5$ and $A_4$ in Fig. 135; then the line $f_4\ i_4$, and the auxiliary line drawn through the point $b_4$ will lie in the same plane. Through the point $f_4$ in the arc $C f_5\ C_3$ draw a straight line towards Fig. 136, and parallel to $C_3\ C_4$, this line will intersect the line $l\ g_5$ in the point $g_4$. Also, through the point $i_4$, in the arc $C_3\ i_5\ C_4$, draw another straight line parallel to $C_3\ C_4$, towards the line $h_5\ o$ in Fig. 136 intersecting the line $h_5\ o$ in the point $h_4$; join the points $g_4$ and $h_4$; then the straight line $h_4\ g_4$ will represent the same line which has been drawn from the point $f_4$ to the point $i_4$ in Fig. 134. In Fig. 134, we see that the line $f_4\ i_4$, and the auxiliary line drawn through the point $b_4$, lie in the same plane; and since the $f_4\ i_4$ is represented by the line $g_4\ h_4$ in Fig. 136, and the line $b_4\ c_4$ by the line $d_4\ e_4$, we conclude that the point of intersection $e_4$, between the line $g_4\ h_4$ and $d_4\ e_4$ in Fig. 136, is the point in which the auxiliary line $d_4\ e_4$ pierces the surface of the outer crown sheet, and the distance between the points $d_4$ and $e_4$ is the length of the auxiliary line. The line $d_{14}\ e_{14}$, Fig. 136 (which is concealed in Fig. 134 by the line $b_4\ c_4$), and the line $g_4\ h_4$, also lie in the same plane; hence the point of intersection, $e_{14}$, between the lines $g_4\ h_4$ and $d_{14}$

*By the term "plane" is meant a straight surface without any thickness.

$e_{14}$, is another point in which the surface of the outer crown sheet is pierced by an auxiliary line; and the distance between the points $d_{14}$ and $e_{14}$ is the length of this auxiliary line. In a similar manner, and plainly shown in our illustrations, we find the points in which the other auxiliary lines will pierce the surface of the outer crown sheet, and thus obtain the length of each auxiliary line.

Let *M N O P*, Fig. 137, represent the edges of the plate on which the dome sheet is to be laid out. Parallel to the edge *M N*, and close to it, draw a straight line, *s t*; on this line lay off the points $u_1$ on right hand side, and $u_1$ on left hand side; the distance between these two points must be equal to the circumference of the circle in Fig. 135. The diameter of this circle being 27⅝ inches, its circumference will be 86.78 inches; hence the distance between the points $u_1$ and $u_1$ in Fig. 137 will be 86.78 inches. Divide this distance into the same number of equal parts as contained in the circumference of the circle in Fig. 135, namely sixteen, and mark the points of division $u_2$, $u_3$, $u_4$, etc. Through each of these points draw a straight line, perpendicular to *s t*. These lines will represent the auxiliary lines assumed to be drawn on the outside of the dome, and therefore the auxiliary lines on the plate must be of the same length as that of the auxiliary lines shown in Fig. 136, each to each. Therefore, make $u_1$ $r_1$ in Fig. 137 equal to $d_1$ $e_1$ in Fig. 136, $u_2$ $r_2$ equal to $d_2$ $e_2$; $u_3$ $r_3$ equal to $d_3$ $e_3$; $u_4$ $r_4$ equal to $d_4$ $e_4$, and $u_5$ $r_5$ equal to $d_5$ $e_5$. But now recollect that the line $d_4$ $e_4$ in Fig. 136 conceals $d_6$ $e_6$, and both are of the same length; $d_3$ $c_3$ conceals $d_7$ $e_7$; both of these are also of the same length. And so each of all the other auxiliary lines shown in Fig. 136, except $d_5$ $e_5$ and $d_{13}$ $e_{13}$, will conceal an auxiliary line, and which of these lines are concealed can easily be seen by referring to Fig. 135. Consequently, the length of the line $u_6$ $v_6$ in Fig. 137 must be made equal to that of $d_4$ $e_4$, $u_7$ $v_7$ equal to $d_3$ $e_3$, $u_8$ $v_8$ equal to $d_2$ $e_2$, and so on. Through the points $v_1$, $v_2$, $v_3$, etc., draw a curved line; on the outside of this draw another curved line, *S A T*. The distance between these two lines must be equal to the lap (as shown by the shaded parts), namely 2½ inches. On the outside of the line $u_1$ $v_1$ on the left, draw a straight line, *S s*; the distance between these lines must be equal to half the lap, that is, 1¼ inch. Also draw *T t* on the right; the distance between this line and $u_1$ $v_1$ must be also equal to 1¼ inch. Cut the plate to the lines *s t*, *S s*, *T t*, and the curved line *S A T*.

HOW TO LAY OUT THE HOLE IN THE TAPERED COURSE.

Draw the horizontal line $c_1$ $c_9$, Fig. 138; on this line lay off the points $A_2$, $A_3$, $A_4$, etc., in the following manner: The distance between the points $c_1$ and $A_2$ must be equal to that between the points $f_1$ and $f_2$ in Fig. 134 and measured on the arc $C_2$ $C_1$, and not on the straight line $b_1$ $b_9$; the distance between the points $A_2$ and $A_3$ must be equal to that between $f_2$ and $f_3$; from $A_3$ to $A_4$ equal to that from $f_3$ to $f_4$; and in a similar manner the other points, as $A_5$ $A_6$, etc., are located. Through each of these points draw a straight line, perpendicular to $c_1$ $c_9$; make the line $c_2$ $c_{16}$ equal to the distance between the points $e_2$ and $e_{16}$ in Fig. 136; the length of the line $c_3$ $c_{15}$ equal to that between $e_3$ and $e_{15}$, and so on, but always keeping the centers of the lines $c_2$ $c_{16}$, $c_3$ $c_{15}$, etc., on the line $c_1$ $c_9$. Join the points $c_1$, $c_2$, $c_3$, etc., by a curved line; inside of this curved line draw another curved line. The distance between these two must be equal to the amount of lap, namely 2½ inches. Cut the hole in the sheet to the curved line $h_1$ $h_2$ $h_3$, etc.

The curved line through the points $e_5$, $e_4$, $e_3$, etc., in Fig. 136, represents the line of intersection between the two cylindrical surfaces. The curved line through the points $c_1$, $c_5$ $c_9$, $c_{13}$, etc., in Fig. 134 represents the same line of intersection. This line, in Fig. 134, is obtained by making the length of the line $b_1$ $c_1$ equal to that of $d_1$ $e_1$ in Fig. 136, $b_2$ $c_2$ equal to $d_2$ $e_2$, and so on, thus obtaining the points $c_1$, $c_2$, $c_3$, etc., and then drawing a curved line through these points. For laying out boiler work, it is not necessary to draw these curved lines; the positions of the points $e_1$, $e_2$, $e_3$, etc., are all that is necessary.

Our object in showing these lines of intersection is to make this problem complete, and valuable to readers of the AMERICAN MACHINIST, who are not boiler makers. In fact, all these problems relating to laying out boiler work are excellent lessons in practical drawing. Not only boiler makers, but all mechanics who wish to become more than ordinary mechanics, should endeavor to understand these problems; they should provide themselves with a drawing board and a few drawing instruments, and draw these problems out on paper, and then apply the principles connected with these problems to other problems. Thus, for instance, if the construction in Figs. 123 and 124 is understood, then the reader will have no difficulty in laying out iron for an elbow, as shown in Fig. 139. If the construction in Figs. 130 and 131 is understood, then the student will easily be able to lay out the iron for a boiler having the steam dome on one side, as shown in Fig. 140. And again, the principles connected with the construction in Fig. 134 are applicable in laying out two pipes whose axes are not at right angles to each other, as shown in Fig. 141. The student should try and solve the problems shown in Figs. 139, 140, 141. Those who are not boiler makers should consider these problems simply as problems relating to the intersections of cylinders, then work out the lines of intersections of these cylinders, and develop the surfaces of the same. The time spent in the solution of these problems will be well spent, because the reader will become acquainted with some of the grandest principles of practical drawing—principles which are applicable in the solution of a great variety of other practicable problems, thus obtaining a knowledge of practical drawing which may prove to be to him of the greatest value. Try it.

We recently heard it mentioned as an instance of good business capacity, that a man who five years ago was engaged in selling water wheels, was at the present time busy in selling steam-engines to run them. There is nothing like adapting oneself to altered circumstances.

Angus Sinclair, in a private letter from Glasgow, writes us: "In this city business is exceedingly dull, and great numbers are going around idle."

## New Cable Road System.

According to the New York Sun, S. H. Terry, of St. Louis, has invented a new cable street railway system which promises to revolutionize the present methods. The cable will not run in an expensive conduit, imbedded in a costly foundation of concrete, but will run in a slotted six-inch iron tube that can be permanently attached to the ties of any ordinary street railway by means of iron chairs. Resting on a chair on top of the ties the open slot of the tube will come on a level with the street surface. There will be no sheaves or pulleys, for the cable, it is claimed, will slide along silently through the tubing. The grip is another novelty entirely different from those now in use. It resembles a pair of tongs that grip the cable from the sides instead of top and bottom. A grip car and a section of road for experimental purposes are now under construction.

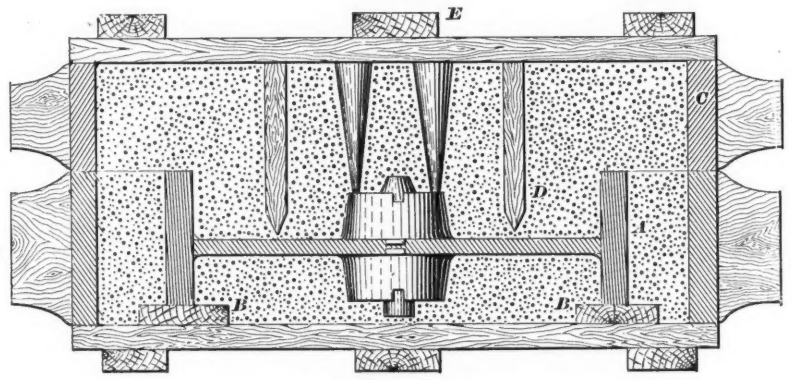



*Fig. 1*

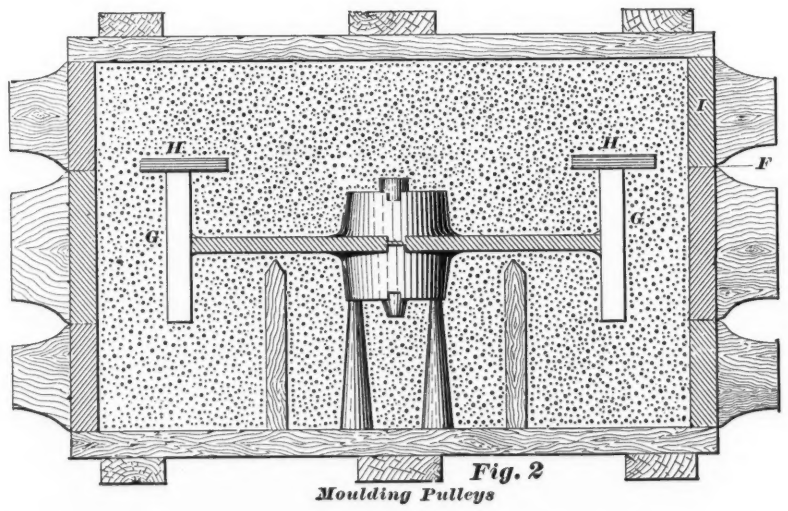



*Fig. 2*

*Moulding Pulleys*

## Moulding Pulleys.

BY ROBERT E. MASTERS.

A pulley was wanted off a 30″ diameter 6″ face ring pattern to be drawn up 2″ for an 8″ face pulley. The plate to lift the core out from over the arms was found to be broken so as to be useless.

The pulley was made on the plan shown without waiting to cast a new plate. The rim *A*, Fig. 1, was set in the cheek on four 2″ blocks *B B*, the edge of the rim with the holes in to draw it out by being down on the blocks, or, in other words, the reverse to what it would be if a plate was used. The pulley was rammed up, the arms bedded in and a parting made the same as for a lifting plate.

The cope *C* was then rammed up, the upper half of the core *D* being rammed up with the cope and well secured with bars and gaggers. The bottom board *E* is put on, the flask clamped together and turned over as shown up to the line *F*, Fig. 2. The blocks were then taken out and the pulley rim drawn up 2″ to make the 8″ face; after this had been rammed up and an even joint made the pulley rim was drawn from the mould as shown by the space *G G*; flat cores *H H* were placed over the rim, and the drag *I* carefully rammed up and the flask turned back.

The rim pattern now being out gives plenty of room to lift off the cope *C*, Fig. 1, without tearing up the core *D*; the arms and hub can then be drawn out and the mould finished.

If a three part flask with a cheek of the proper depth is not to be obtained, a two part flask with a little deeper drag than the face of the pulley will answer the same purpose. Bed the rim of the pulley in with the pattern upside down without using the blocks *B B*. After turning over the first time scrape the sand away down to the pattern, draw the pattern up to the width of the face required, make a smooth surface to lay the cores *H H* on, draw the pattern, cover the rim with the cores, ram the rest of the drag up and finish as described above.

## Committees and Subjects for Discussion at the Twentieth Annual Meeting of Railway Master Mechanics' Association, June, 1887.

*By Courtesy of J. H. Setchel, Secretary.*

No. 1. PROPORTION OF LOCOMOTIVE CYLINDERS. To give the best results, what rule should be followed for proportioning the cylinders of an engine, when the size of driving wheels, weight available for adhesion and boiler steam pressure are given quantities?—Charles Blackwell, U. P. R. R.; F. C. Wanklyn, Grand Trunk R. R.; T. E. Barnett, Canada Pacific R. R.

No 2. TRACTION INCREASERS. Their various types and relative merits; also cases in which their use can be recommended.—R. H. Briggs, Ches., Ohio & S. West R. R.; D. O. Shaver, Pennsylvania R. R.; T. J. Hatswell, F. and M. R. R.

No. 3. CROSSHEADS AND GUIDE BARS. The various types in use; the materials and their construction, and results obtained.—F. M. Dean, U. P. Howison and J. B. Henry, New York and New England R. R.

No. 4. STEAM PACKING. The various forms of piston packing in use and obtained results; also the most economical and satisfactory packing for piston-rods, valve-stems, regulator and air-pump stuffing-boxes, with results obtained.—J. W. Stokes, Ohio and Mississippi R. R.; Allen Cook, Chicago and East Illinois R. R., Henry Schlacks, Illinois Central R. R.

No. 5. LOCOMOTIVE PREPARATION. Washing and lighting up locomotives; showing the best system in use for washing out, and most economical and expeditious mode of raising steam in firing up, and the necessary plant for same.—G. W. Ettenger, Ches. and Ohio R. R.; W. H. Thomas, E. T. V. and G R. R.; T. W. Gentry, Richmond and Danville R. R.

No 6. COALING UP LOCOMOTIVES. The various plans in use, and their relative cost and efficiency.—J. Davis Barnett, Midland R. R.; James Strode, Northern Central; CharlesGraham, D. L. and W. R. R.

No. 7. STANDARD FORM OF TIRE SECTION.—J. N. Lauder, Old Colony R. R.; Jacob Johann, Chicago and Atlantic R. R.; H. N. Sprague, Pittsburgh.

No. 8. What Control has the Engineer over the Wear of Driving Wheel Tire?—John McKensie, N. Y. C. and St. L. R. R.; J. S. Graham, L. S. and M. S. R. R.; Fred. B. Griffith, D. L. and W. R. R.

Associate Members' Papers.—F. B. Miles and Robert Grimshaw.

General Supervisory Committee. Printing and "Boston Fund."—William Woodcock, Jacob Johann, R. H. Briggs, J. H. Setchel and Geo. Richards.

Standing Committee Subjects.—T. B. Twombly, C. R. I. and P. R. R.; Charles Blackwell, U. P. R R.; George Hackney, A. T. and S. F. R. R.

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[The above comprises all, except "Obituary Committees," of which there are five.]

The *Journal of the Franklin Institute* for August contains a paper on "The Refrigerating Machine as a Heater." The title suggests a lecturer who remarked, "There is heat even in snow." Whereupon one of his audience exclaimed, "Then how many snow balls will be required to boil a tea-kettle?"

## LETTERS FROM PRACTICAL MEN.

### Information Wanted About Chimneys.

*Editor American Machinist:*

I have received a letter from R. M. Bancroft, ex-president Civil and Mechanical Engineers' Society, London, England, asking me if I can tell the height of the tallest chimney stacks in America, internal area, name of works and town where it is situated, and whether it is built of brick, stone, iron, or concrete. I replied that I would try to obtain the information for him through the columns of the AMERICAN MACHINIST.

Mr. Bancroft is especially interested in this class of work, and is the author of a work on "Tall Chimney Construction in Stone, Brick, Wrought Iron, and Concrete," and any information from your readers on the above subject will be appreciated by him.

ROBERT E. MASTERS.

### Blake Independent Condensing Apparatus on the "Boston."

*Editor American Machinist:*

In a late number of your paper there is an article on the "Dock Trial of the U. S. S. Boston," and therein it is stated that the vacuum was only 16.25″. This is a mistake of the types, it should read 26.25″ vacuum. As we furnished the direct-acting independent system that operates the air and circulating pumps, we beg to ask you to make the correction.

We would also like to add that this very satisfactory vacuum was held (when the engine was running about 60 revolutions per minute) with less than 40 revolutions of the Blake independent air and circulating pumps. Later on in the trial the air and circulating pumps were connected direct to the main engines, and of course then made the same number of revolutions as the engines.

We consider the above a good demonstration of the economical value of the independent system of air and circulating pumps.

GEO. F. BLAKE MFG. CO.

[While our correspondents are wrong in attributing a mistake in the figures as to the vacuum in the preliminary running of the engines, they are right in bringing out the statement that this was no fault in their work. Further along in the article it is shown that when run at nearly double the speed, with double steam pressure, the vacuum was a little better than given in the above communication. We supposed this would have led to an understanding of the fact that in the preliminary running it is not practicable to get the same vacuum as after everything gets down to working conditions.]

### To Prevent Castings from Cracking.

*Editor American Machinist:*

There are some kinds of castings that are very likely to crack. One I have in mind is a wheel with a rim 6″x7″ and arms 1½″ thick, by 3″ wide. To prevent this, as soon as the casting is hard enough to handle, remove all the sand that will make steam and bury the casting in dry sand, such as is used for parting sand; it is better if it has been burned.

Any casting that is likely to crack, and can be handled without warping may be saved in this way. I have tried it many times without failure.

WM. STUART.

### Oiling Lathe Carriage Ways.

*Editor American Machinist:*

The average builder of engine lathes makes no provision for oiling the carriage ways. Just why he does not is one of the things past finding out. When a lathesman begins work in the morning he squirts a liberal supply of oil—enough to last a month if properly applied—on the ways and moves the carriage back and forth three or four times; this serves for the day. The edges of the carriage V's are sharp, and when he moves the carriage along they scrape about 99 per cent. of the oil off, and of the remaining one per cent. not much ever finds its way under the center of the carriage.

When a new lathe comes into the shop the intention is to put on wipers. But there is always lots of work for the new lathe, and the supposition is that a pattern or two must be made. Of course we cannot stop just now; must get over the rush first. Those wipers on the new lathe are one of the machine shop jobs, that will be done when "we get time," and no one in a machine shop ever gets time.

The sketch shows a simple plan that takes next to no time, and I can vouch for its answering every purpose. All that is necessary is to drill holes, as shown, 2″, or to suit the size of lathe, from ends of carriage arms, and the size of V's. Then tap with a fine thread tap and make shallow plugs to fill. If desired the plugs may have small oil holes through them. Fill these holes in carriage with waste, or similar material, and the ways will always be oiled.

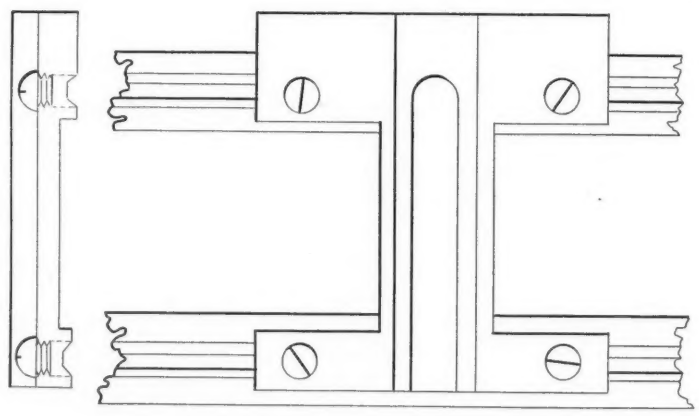
Troy, N. Y. WM. H. BRADT.

### The Apprentices' Library.

It is doubtful if one-half the mechanics of New York City know even of the existence of one of the oldest free libraries in the country; the Apprentices' Library, located at No. 18 East Sixteenth street. This library was established in 1820, as implied by its name for the benefit of apprentices, but its privileges have been gradually extended until now it is free to all. The *Commercial Advertiser*, from which we glean the above facts, says of this library:

"The library is well equipped in every respect, and compares favorably in its method of arrangement, catalogues and general manner of doing business with any library of its size in the United States. It has more than 70,000 carefully selected volumes, embracing works on all branches of literature, science and art. All the popular new publications are added as fast as they are printed. A new catalogue will be published shortly containing, in one volume, a brief guide to all the books in the library, on a plan easily understood by the general reader. A card catalogue giving fuller information, and showing the resources of the library in a more complete manner than was possible in a printed list—except at a greatly increased expense—is nearly ready, and will be cheerfully placed at the service of those readers who wish to make extended researches. This catalogue will combine, on a novel plan, the chief merits of the two rival systems of cataloguing, viz., the systematic and the dictionary. * * *

"A free reading room is connected with the library, and contains, in addition to all the popular magazines, periodicals and newspapers, a valuable reference library of 5,000 volumes. The library is open every day from 8 A. M. to 9 P. M."



OILING LATHE WAYS.

### Work and System in the Drawing Room.

BY C. L. REDFIELD.

Since the introduction of the blue print process a few years ago a great change has come over the ordinary drawing room work. The old plan of making full sized drawings on large boards, which were afterwards shellaced and sent into the shop, has almost entirely passed away.

A later plan, which is still followed by many establishments, is that of sending into the shop original drawings shellaced over, or tracing from these original drawings. Both of these plans entail a large amount of unnecessary labor, besides the additional disadvantage of subjecting the drawing to the danger of loss or destruction.

The more modern and better plan makes the tracing itself the original from which any number whatever of blue prints may be taken, everyone of which will be exactly like the original in every line and figure. The human hand when making a copy or tracing of a drawing is liable to error, but a blue print never.

When an establishment decides to adopt the plan of using blue prints for the shop it is also desirable at the same time to adopt some system of sizes and style of drawings and mode of filing, numbering and preserving them. It has fallen to the lot of the writer on more than one occasion to make the change from an old disorganized system or rather lack of system to some definite plan of arrangement using blue prints, and on each occasion the plan, though starting with the same idea and aiming at the same end, differed more or less in its details from that of its predecessor. This difference in detail, which necessarily exists in every case, was due to the difference of manufacture and the different conditions under which the start was made.

The person who engineers the change should make himself familiar with the details of the work done, nature and condition of the drawings on hand, the space and conveniences which he can command, and the general capabilities of the men who are to use the drawings. Any person who makes a system complete in all its details, so that a maximum of efficiency will be obtained from a minimum of labor and expense, must put considerable time and study on the subject. The person who attempts to do it in a day or week is sure to make a system lame in many of its particulars.

One of the first things to be done is to adopt a standard of sizes for drawings. The sizes adopted depend somewhat upon the sizes of paper and tracing cloth that can be obtained, and upon the nature of the work. In my work at present the largest standard size is 32″ × 48″, the other sizes being divisions and subdivisions. For occasional scraps that go into a class called miscellaneous the size 12″ × 16″ is sometimes divided, but I use no standard drawing smaller than 12″ × 16″. Mill plans and some special drawings take sheets larger than 32″ × 48″. These drawings I make no larger than necessary and without any respect to standard sizes. Probably three-quarters of the drawings in our office are on sheets 16″ × 24″.

When making a drawing it is not necessary that it be finished in ink on the paper, as it may be traced on the cloth direct from the pencil drawing. If the drawing is not of too complicated a nature this work may be done by apprentices; the dimensions, lines and figures, of course, should be put on by the draftsman himself, and his name should be appended to every drawing for which he is responsible.

The paper on which the pencil drawing is made should also be suitable for blue prints, so that after the tracing is made, and it is of no further use in the drawing room, it can be turned over to the print room and a blue print made on the other side.

By exercising a little ingenuity the tracing cloth, as it comes in rolls, may be cut up into the required sizes without any waste. Thus, if the ordinary size of drawing is 16″ × 24″, and the tracing cloth is 42″ wide, then if a piece 48″ long be cut off, it will when the selvedge edge is removed present a piece 40″ × 48″, which may be cut into three pieces 16″ × 24″, and one piece 24″ × 32″, or it may be further divided as required.

Tracing cloth as it comes from the rolls is in a very inconvenient form, and should be straightened out, before using, into sheets that will lie flat without the corners curling up. This may be done by drawing it gently over the edge of a table or board with the convex side of the cloth down. While drawing it over the edge it should be bent back either with the hand or the concave part of an ordinary three-cornered scale. A little practice will enable any one to straighten an ordinary sheet in a few seconds. If the sheets are large this process is open to the danger of wrinkling them unless great care is taken. A better plan to adopt with large sheets is to roll them up in the reverse position to that in which they have been, and allow them to remain so for a few minutes with elastic bands on them, after which the corners may be finished over the edge of the table.

After the cloth is tacked down, and before commencing the tracing, if if be rubbed over with a little powdered chalk it will remove the greasy nature of the surface, and the ink will flow much more easily and evenly.

The ink should be the best, and mixed until, when tested with a pen, a light line will show just as black as a heavy one. In summer much annoyance is often experienced by flies eating the ink off the tracing. This may be effectually avoided by mixing the ink with vinegar instead of water. If the dish in which the ink is mixed be made as hot as can be held in the hand, the mixing process may be performed in about a quarter of the time required when the dish and water are cold.

The lines of a tracing intended for blue printing should not be much less than one-sixty-fourth of an inch in width. Very fine or pale lines do not print well.

Whether a drawing should be shaded or not must be left to the judgment of the draftsman. Generally shading is superfluous.

Dimension lines should be put on with red ink, and end in arrow-heads of black ink. Red ink being less impervious to light than black ink, these lines will show paler in the print, and are readily distinguishable from the other lines of the drawing. The best ink for this purpose is Windsor and Newton's carmine cakes, mixed up in a saucer the same as India ink. If the carmine in the saucer dries up it is not lost as, unlike India ink, it may be mixed up again by adding a little water to it. A very convenient way of keeping water for this purpose is in a small, corked bottle, with a goose-quill through the cork. A few rapid, jerking motions will throw a few drops of water at a time out through the quill into the saucer. If the carmine cakes cannot be readily obtained, the next best thing is the ordinary red ink evaporated down to about one-fourth its original volume, so that the lines will not be too pale. Should red ink be not obtainable, and it is necessary to use black ink, then the dimension lines should be made in broken, not dotted, lines.

The manner in which dimensions are put on a drawing tell more of the draftsman's experience and judgment than any other one particular. It may be set down as a maxim that no dimension should be put on a drawing unless it is an essential one, and no essential one should be left off. Every dimension given that will not be actually used only tends to make a drawing confusing, and any drawing which must be measured because dimension figures are lacking is faulty. No drawing should be measured by any one but the draftsman, as long as he is alive and can be found. This does not constitute an excuse for not making a drawing accurately to scale, but, if rigidly adhered to, does allow the draftsman to make a minor change of figures without the necessity of the labor and expense of making a new drawing, which no one, without the aid of a

scale, would be able to detect from the old one. How and where the dimensions should be given with reference to the other lines of the drawing, no rule can be laid down, except the very general one that they should be placed where the workman would most naturally look for them, and that they should not be crossed by any other line of the drawing.

All finished drawings should have printed on them, in a neat and uniform style, the title, name of manufacturer, the scale, date and name of the draftsman. The following will give a fair idea of a very good style:

10″×16″ CYLINDER.
CUT-OFF ENGINE COMPANY.
INVENTORVILLE, UTOPIA.
SCALE, 3″ = 1′. MAY 29, 1886.
BIGHEAD, DEL.

All drawings, except very large ones, should be kept flat in a case of drawers. The drawers should be from 2″ to 6″ each way larger than the drawings which they are intended to hold. The proper depth for a drawer is about 2″ or 2½″. To prevent the danger of drawings working out over the back and becoming wrinkled and spoiled the back part of the drawers may be covered over for about one-half of their length.

Drawings that are too large to be conveniently kept flat may be rolled up, but they should never, under any circumstances, be folded. A folded or wrinkled drawing soon becomes worthless for blue printing purposes, as every fold or wrinkle shows in the print.

As to how drawings should be classified, and whether numbered or not, so much depends upon the varying conditions that very little can be said, except in a general way. In one case the writer worked for more than six months, and in another case more than a year, under an existing system of numbering before he finally discarded it for a better one. In still another case, he worked for more than a year without any numbering at all, before any definite plan developed itself. In general, it may be said that numbering is essential to a large number of drawings, and a large number of drawings is essential to a system of numbering. To adopt a system of numbering with a small number of drawings is generally productive of more trouble than convenience. A plan of numbering to be of any practical value must be both comprehensive in its scope and simple in its application.

During the early stages of a change to a definite system, it is generally better to postpone any plan of numbering until it becomes necessary on account of the increasing accumulation, but the idea that they are to be eventually numbered should be constantly kept in mind. In the beginning drawings will probably all be kept in a single drawer. By the time there are 40 or 50 of them, they may be divided into separate drawers, labeled somewhat as follows: "Engines," "Foundations," "Boiler Settings," "Mill Machinery" and "Miscellaneous." As the drawings increase in numbers they may be divided into "Large Engines," "Small Engines," "Yacht Engines," etc. At a later stage, each size of engine or machine may be given one or more drawers by itself. By this time, if not before, a plan of numbering will have become imperative. Where the plan of manufacture comprises both the duplication of parts and the variation of the machine to suit circumstances, a system of numbering becomes a necessity, and will take place sooner.

Just what plan of numbering should be adopted must be decided for each individual case according to the particular circumstances. Probably the best hint I could give would be to outline a system I once adopted for a line of engines. Each size of engine was given 100 numbers as its special property, of which as many were used as were required. The numbers for the smallest size began at 1; those for the second size at 101; for the third size at 201, and so on. Then a list for drawings was made in a certain specified order, so that if the drawing for the smallest cylinder was No. 1, then the drawing for any other cylinder would be No. 1, with its proper hundred prefixed, the same being true for any other number. By this plan the number for any drawing was predetermined, and was not deviated from under any circumstances. Should there be any changes in any particular piece so that there would be two or more drawings for it, as, for instance, a rock-arm, No. 23, the second drawing would be No. 23A, the third No. 23B, and so on. Each engine built was given a distinct order number which bore some relationship to the diameter of the cylinder; thus the first 10″ engine would be No. 1001, the third 12″ engine No. 1203, and so on. To keep a complete record of every engine built, and be able to supply any broken or lost piece at short notice, a blue print was taken of the list of drawings and the order number of the engine placed at the top. Any variations from the original drawings was noted in the margin opposite the numbers of A, B, or C, as the case might require. Any other engine built exactly like this one merely had its number placed at the top beside the one already there, while any engine that varied from it had a separate list. This system, though comprehensive enough to cover every possible condition, was so simple and manageable that a drawing could be referred to almost as soon as spoken of. The principles underlying this system may, by a little ingenuity, be made applicable to almost any kind of manufacture.

The blue printing is better done in a room separate from and adjoining the drawing room. The necessary outfit consists of a printing frame, a large shallow pan for washing the prints, a frame or rack for drying, and a case of drawers for drying and preserving the prepared paper.

## An English Vertical Boiler.

In a small vertical boiler shown at one of the industrial exhibitions in England, the shell of the boiler encases a conical flue extending to the top head. This flue at the bottom is a little larger than the shell proper, the latter joining the flue just above the fire, which is in the base of the flue. The flue tapers regularly to the top head where it terminates in the beginning of the smoke stack. The flue is double, enclosing a narrow water space up to within a few inches of the upper head, at which point the water space communicates with the steam space of the boiler; water that may be carried over in this narrow water space is deflected downwards through the steam space. The water space of the flue is in communication with the water in the shell of the boiler through circulating tubes. The heating surface is, of course, the interior surface of the conical tube. The performance of this boiler is well spoken of.

## Condition of Labor in Germany.

Upon this subject Consul Warner says:

"The wages throughout Germany may be described as very low. In Westphalia and Rhineland wages are generally at their best, but in poorer districts the standard is much lower, notably in Upper Silesia, where the laboring classes earn from 30 to 40 per cent. less than in those districts even. In the latter a laborer, whether he works in iron or steel works, manufactories, coal mines, stone quarries, buildings, or railways, earns, as a rule, from two to three marks (say 47 to 70 cents) per day, and if he is a skilled laborer he may get three and a half to four marks (say 80 to 92 cents) per day. Female labor is allowed only in certain cases, and women, when employed, earn from one mark to one mark and a quarter (say 24 to 30 cents) per day. If a woman is debarred from getting employment, then she generally seeks to earn money by needle work or light work of similar kind, so as to add to the means for supporting the family. Boys under sixteen years of age on leaving school are taken into employment, and receive eighty pfennigs to one mark (say 19 to 24 cents) per day, and extra strong boys may earn 30 cents per day.

"The working hours are from 6 to 6 in summer, and 7 to 7 in winter; one hour is allowed for dinner, half an hour in the morning for breakfast, and half an hour in the afternoon for coffee.

"On Sundays work is suspended, except when urgent repairs are required. The Government has no power or right to interfere with the working hours, but it takes care that certain restrictions with regard to the employment of women and children are observed.

"Latterly, the system of paying the laborers by piece-work has been generally adopted, and the wages thus earned are on a scale already referred to. To provide for sickness and accident, as required by law, the workman is obliged to contribute to a saving fund out of his earnings.

"As to his mode of living, he requires for rent from twelve to eighteen marks (say from $2.85 to $4.20) per month, so that in fact one week's wages are entirely expended for this item. * * * *

"His meals consist principally of potatoes (for dinner, potato soup with a slice of bacon), peas, beans, vegetables, common pork and black bread, sometimes dried fish, and now and then ordinary beef meat, but more frequently horse-flesh.

"The laboring man is, as a rule, rather sparingly supplied with clothing and linen, and a white shirt is to be seen only on rare occasions. For these articles he has but little money left, and is often reduced to bargain for old and left-off clothes and things.

"The careful laborer, however, finds it more to his interest to procure these articles, as well as the necessaries of life, at the co-operative stores, which now exist almost everywhere.

"Here the workman finds the largest selection, the best goods, and the fairest prices, and if he can produce his tax receipt he is allowed to have goods on credit, the laborer engaging to pay on receipt of his weekly wages; those who are paid by the month are permitted to pay at the end of the month."

## See that the Boys Learn.

BY JAMES F. HOBART.

The general knowledge possessed by boys and young men in shops and factories is sadly less than it should be. The boys in question are often ignorant of the simplest principles of the work they accomplish day by day.

A well-known manufacturer remarked that the deficiency of knowledge among boys in his shop was something to be deplored. He had three bright boys about 16 or 17 years of age who seemed as intelligent as the average run of boys, yet the fact was developed that neither of the boys knew what was meant by the term diameter of a circle.

Two of these boys had worked in the machine shop for two years, and the third boy, who had recently begun work in the shop, was recommended as "understanding considerable geometry" when he applied for a position in this shop.

Two of these boys had done fine machine work for many months. They worked to micrometer measurements as a matter of course, and were able to bring stock to the desired size and shape within one-quarter of one-thousandth of an inch, yet these boys did not know what was the diameter of a circle.

It is generally supposed that any school boy knows all about circles, squares and their constituents, yet the school boy has been told these things, while the shop boy never heard of them. He is given a job; he is shown how to set lathe or machine in order to do that job, but never a word does he hear about the technicalities of the work, the reason why, or anything about the principle upon which depends the correctness of his work.

These boys learn to turn out a great quantity of first-class work, yet they don't know the first thing that will make them valuable as machinists, or which will advance them toward carrying on business for themselves.

Any manufacturer or any foreman is willing to tell a boy why such a thing is done if he has the least intimation that an explanation is needed or desired.

We need more rudimentary education among the shop boys than they are getting at present. It does not require much time to tell about the little things that occur in every-day practice, but it will not do to suppose the boys know all these points simply because they ought to know them. This is the way things have been going on, and this is what causes the present state of shop-boy knowledge. Many of the boys do not realize that there is a field of study for them which will prove more interesting than base ball matches, or even "going a-fishing." Let the boys once understand that they can learn lots of things beneficial to them from books. Let them be shown how to learn these things, and the technical school business will be outdone.

Some of the boys, it is true, would never learn, even with the best opportunity, but give them a chance, all the same, that, if the germ is there, it may have a chance to take root and grow steadily toward the light of knowledge.

Only a word or two will often start a boy to thinking that he can improve himself if he chooses, and fit himself for a responsible position. If the boy is ambitious, nothing more is necessary. He will take care of himself and learn as a weed grows.

Real good machinists, they say, are becoming scarcer every day, and real skilled labor is hard to find. The technical school is working out a stock of embryo engineers and artisans, but give the shop boy's thoughts a start in the right direction, and if he possesses latent talent to be of any use in the mechanical world, that talent will assert itself, no matter if he is doing monotonous machine feeding or general boy's work all around the shop.

Try the experiment of finding out what the boys know, and what they don't know. Help them to do a little thinking for themselves, and see how quickly they will acquire more knowledge, and use it intelligently for your benefit.

Many a boy is working in a shop who will never do anything but run the automatic machine, and be himself a part of that machine, but there are boys in the shop who don't know what is meant by the diameter of a circle, or the diagonal or a parallelogram, yet these same boys will expand into useful, ingenious mechanics, if you but once give them a start in the right direction.

A little time and trouble taken for the shop boys will not cost you much, but it will prove the best invested expenditure you ever made. Help the boys by letting them know how to learn.

## Compressed Wood for Tooth-Gearing and Shuttles.

We have received a number of samples of beech and other woods compressed by hydraulic presses under the patent of Mr. Robert Pickles, of Bromley, who makes this material a specialty for shuttles and for gearing. The compression of the wood improves its wear-resisting capacity in an unexpected degree. The wood is sawn into sizes necessary for making shuttles or cogs, and naturally dried. It is then compressed under a pressure of about 15 tons per square inch in a rectangular space in the press holding six shuttle blocks, packed three side by side and two deep; above is a metal block which is made so as to fit the space in the ram. The depth of the blocks before compression is 2¼ in., and it is reduced to 1¼ in. The kinds of compressed wood sent us are beech, persimmon, and cornel. The grain is very close, and the weight of the compressed beech is greater than that of box-wood, and remarkably heavier than uncompressed beech. We have no figures as to the wear of the wood as cogs, but should expect it to last a very long time and to run very easily. It may be mentioned that the samples sent us are 1.25 in. by 1.437 in. by 4.625 in. Of the beech, the uncompressed piece weighs 3.24 oz., and the compressed piece no less than 4.91 oz., or 1.66 oz. heavier.—*The Engineer.*

A steel tea chest, made by machinery, is said to be impervious to water, and of but one-half the weight of a wooden chest. It will cost only three-fourths as much, and may be conveniently opened by removing four screws in the lid.

Experiments are being made on quite a large scale of making steel pipe. An experimental plant for the purpose has been erected at the National Tube Works, McKeesport, Pa.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

**American Machinist Publishing Co.**

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.

**96 Fulton Street, New York.**

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

**The American News Company,**
Publishers' Agents, New York.
**The International News Company,**
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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, AUGUST 28, 1886.

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## Patent Law Reform.

We have recently given considerable space to matters relating to reform in the patent law. It is in every sense an important subject, and one upon which there should be no hasty, ill-advised legislation. A large share of the business prosperity of the country can be traced directly to the liberality of our patent laws, which has given men of small means a chance to enter the field with their inventions. Nothing should be done to curtail these privileges, or in any way make the procuring a patent on an actual invention harder than it now is. Perhaps the business of issuing patents has grown to such magnitude that the laws relating thereto should be modified; it would be strange if this were not true. But experience shows that when such things are begun there is always danger of going to extremes. It is always easier to find fault with existing methods than to suggest better ones.

Against the probability of improvement by re-modelling existing laws is the fact that just as they are they have worked almost infinite good to the whole country. They are unquestionably better than similar laws in any other country; nothing but results are needed to show this to be a fact. When a patent is granted it is to be expected that it will not be satisfactory to others who did not invent a similar device, but the idea that it is a hardship for them to be asked to pay for it if they use it is absurd. It may be easier to work along on old ideas and plans than to have some troublesome fellow invent new and better ones, but it is not progress. Not a little of the argument against all patent law, for there are those who would like to do away with it entirely, has no better foundation than an indisposition to pull out of old ruts.

That injustice sometimes results from the operation of the present laws in regard to patents cannot be gainsaid. This is the case with every human law, however wisely devised. But there is none who gets less justice in the matter than the inventor himself, yet he does the least grumbling about it.

We do not argue against revision of the patent laws when it can be shown that such revision will result in the greatest good. We are of the opinion, for instance, that the patentee, very generally a poor man, should be better protected from infringement by those against whom he cannot proceed under the law for lack of means, but even a change in this respect should be made with great caution. It would be easy enough to protect the patentee if that were the rule, or even the principal object of the law. The main object of the patent law is to secure the ideas of the inventor for the good of the public; incidentally he is protected just as far as is necessary to induce him to make known what he invents, and to stimulate him to invention—hardly to that extent. The patent laws of the United States are particularly democratic in their nature; it would be unfortunate to change them in this respect.

If the decision of the Patent Office in granting a patent could justly be final as to its validity it would save much trouble and expense. Unfortunately this appears to be one of the legions of things which, while being extremely desirable, is equally impracticable. Altogether the subject of patent reform is a very difficult one with which to deal, and the people have a right to demand that when changes are made—for it seems probable that there will be changes—that they shall have the consideration due the importance of the subject. It should not be forgotten that inventors who make use of the Patent Office pay, as pointed out by one of our correspondents, all the expenses; it is also well to look at the fact that some of the most important business enterprises of the country are based on expired patents.

A recent letter from a correspondent in Texas gave an account of an invention the working of which depended upon a hydraulic ram to elevate two-thirds of the water that flowed to it. A later letter conveys the information that it will not work because the ram would not elevate the proportion of water necessary to keep up the motion of the water-wheel over which the water first passed. The same correspondent informs us of the failure of an engine without crank or center. A little consideration of physics would have saved some useless expense in either case. But we learn mostly by experience.

## Indicating Locomotives.

The common practice in taking diagrams from locomotive engines is to instruct the engineer to open the throttle wide just as a diagram is to be taken, between the intervals of taking diagrams, the engine being run with throttle partially closed to regulate the speed. The *National Car and Locomotive Builder* calls attention to the fact that this is wrong inasmuch as the information of the power required to move the train at the speed noted is not denoted by the diagram taken under these circumstances. This is true, but in a more important particular the diagram thus taken is misleading. If steam is throttled, say 20 lbs., which is not uncommon, the temperature of the metal of the cylinder, beyond the mere surface, is materially different from what it would be if there were no throttling. When the throttle is opened there is an effort to bring this temperature up to what it would be under the altered conditions. In this effort steam is condensed during several strokes of the engine, hence this will affect the admission line, the steam line, and the expansion line, to such an extent that no intelligent comparison can be made. Diagrams taken under these conditions are misleading.

In indicating a stationary engine care is always taken not to take a diagram after starting, until sufficient time has elapsed to heat up the metal of the cylinder. It is generally impossible on locomotives to secure all the time desirable after changing the grade of expansion to insure normal conditions, but everything possible in this direction should be done. If it is customary to run with the throttle partially closed, then diagrams should be taken under this condition.

## Interest in Apprenticeship.

We believe that manufacturers are wise in reviving, as we think they evidently are, an interest in some kind of apprenticeship. While there is, and has been all the time, a good many boys learning trades in this country, the number is not equal to keeping up the supply of skilled labor demanded by the increase in manufacturing interests. To keep up this supply, large drafts are made from the skilled artizans of other countries.

It is in every way desirable that this supply should be made up more largely from men born and learning their trade in this country. Many valuable acquisitions in the way of skilled mechanics are had from European countries, but at an average they are not the best that these countries produce. Only a small percentage of the very best mechanics of any country emigrate. They are not the ones who get the best wages and steady employment, and are measurably satisfied.

The best mechanics American manufacturers will have in the future will be those who come up to their trades through American shops. It is unwise to depend upon a supply from any other source. There is no trouble in keeping up a plentiful supply, if a reasonable number of apprentices are given an opportunity to learn trades. There are plenty of boys in the country who are anxious to learn trades, and it is the part of wisdom to give them the opportunity.

Notwithstanding a knowledge of economy in steam engineering has come to be common, there is yet an astonishing waste of fuel even when it is dear in price. Boilers are in use that are doing but little more than half the duty that it is entirely practicable to obtain, and engines in abundance are running, doing quite as poorly. Although it is well known that a good feed-water heater will save from ten to fifteen per cent. of the fuel required, there are hundreds of non-condensing engines from which the exhaust steam is permitted to go entirely to waste. Many users of steam are paying for five tons of coal a day when three is more than they ought to use. A few figures applied to the expenses of the motive plant would often point out means of saving a comfortable yearly income.

## A Peculiarity of Vision.

While riding in the cable cars on the Brooklyn Bridge one may look across and see the return cable passing in the opposite direction. As it runs at the rate of about ten miles an hour, it is passing at the rate of twenty miles an hour, and although made up of strands like a hemp rope it appears like a smooth cord. But if the observer will look between the wheels of the passing car the strands will for an instant become visible the same as if the observer and cable were at rest.

An Italian correspondent is seeking information regarding the development of natural gas in this country with a view to looking for it in that country. In view of recent statements chronicling the finding of natural gas in this country in various localities wholly apart from territory that has ever been regarded as oil-producing, the connection between these two natural products seems to be less intimate than has usually been supposed. It may be that coal is, after all, more nearly related to natural gas than oil. In any case, our Italian friend's enterprise deserves commendation. Let him go ahead. If he don't strike gas, he may strike something else quite as valuable. Perhaps a diamond mine.

The injector was a discovery, not an invention. Its action being based upon an apparent anomaly, has never been easy of explanation. Scientists laugh at the efforts of the practical man to explain the action of the injector, and then set up theories which neither they themselves nor any one else can explain. We are moved to the above by noticing a recent explanation of the action of the injector, which makes the whole subject exactly as "clear as mud."

M. de Lesseps is either a man of a very sanguine temperament or an arrant humbug. He proclaims that the Panama Canal will be completed by 1889; other engineers see substantially insurmountable difficulties in the way of completing the project. If in the face of all the adverse criticism M. de Lesseps is successful he will unquestionably be recognized as one of the foremost, if not the very first, engineer of the age.

*Apropos* of so-called hard times, we recently heard a well-known and successful manufacturer talking about the dullness of trade; but, in conclusion, said he: "This year's business will be considerably better than last." We are of the opinion that this is what is the matter with a good many manufacturers.

## Literary Notes.

The *Southern Cultivator and Dixie Farmer* is a 44 page monthly devoted to farm interests. The August number comes to us filled with interesting contributed and selected matter pertaining to the farm, the herds, crops and household. It also has a mechanical department of interest to both farmer and mechanic.

The National Car and Locomotive Supplement for this year is in many respects the best one yet issued. Although mainly devoted to advertisements of railroad tools, equipments and appliances, it contains other matter of interest, as directories of rail mills in the country, street railway companies, South American railroads, manufacturers of rolling stock and railroad supplies, etc. The advertisements are indexed so as to be readily found. The supplement is a work of over 100 pages, finely printed and illustrated, and arranged to be hung up for convenient reference. A copy is sent gratuitously to every person whose name appears in it, as well as to all railway officials in the United States and Canada. It is prepared and issued by John N. Reynolds, Morse Building, 140 Nassau street, New York.

# QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.*

(309) D. W., New York, asks: Of what use is the floating top in an air pump? Does it fit air-tight? *A.*—It is not tight. It simply serves as a cover to protect the parts from dirt, and to prevent the slopping of water.

(310) J. M. C., Philadelphia, Pa., writes: A rod of ⅝" round iron, 100 feet long, is held securely at the ends; in the center it sustains a weight, and is deflected 3 feet from a straight line. What weight will break it, and what will be a safe load? *A.*—If the iron is of good quality it will probably sustain a little over one ton, at a deflection of 3 feet, before breaking. Safe load will depend upon factor of safety desired. We should say not more than 500 lbs.

(311) G. H. P., Lynn, Mass., writes: I send a sketch of cast-iron crosshead for 10"x24" engine. The pin was cast with the crosshead and is worn out. It was 2" diameter and 3" long. Is there sufficient stock to put in a steel pin, and how large should it be? *A.*—You can put in a steel pin without trouble, as follows: Have the cheeks of crosshead slotted or planed out true with the hole for rod, then in a lathe bore and ream a hole through both cheeks for a 1⅛" bolt. Make a steel thimble for the pin with hole same size as through cheeks of crosshead, and just long enough to push down to place between cheeks. Use a steel bolt with a strong feather to keep thimble from turning around, and also to keep bolt from turning in crosshead. The nut on the bolt will draw the cheeks hard against the ends of the thimble. If the machinist makes a first-class job of it, you will have no trouble. Make thimble 2" diameter.

(312) T. M. Y., Middletown, Pa., asks: What is the Government law in regard to banding boiler tubes? *A.*—The following is from the General Rules and Regulations: "Lap-welded flues over 10 feet, and not over 15 feet in length, shall have two wrought-iron rings attached to the flue externally, equidistant between the ends of the flue, and there shall be attached one additional ring for every 5 feet, or fraction thereof, over 15 feet in length. All such rings shall be good and substantially made, and properly and securely attached to the flues, and shall have a thickness of material of not less than the thickness of the material of the flues, and a width of not less than 2½". Provided, however, where such flues are made in lengths of not over 5 feet, and fitted one into the other, and substantially riveted, the wrought-iron rings may be dispensed with."

(313) J. P., Vineland, N. J., writes: Will you please describe the process, and state the object to be gained, in saturating wood with tungsten and soda? *A.*—Tungstate of soda is introduced into pores of wood by enclosing the wood in an air-tight iron vessel, exhausting the air therefrom and admitting the solution of tungstate of soda while the vacuum is maintained. The object to be gained is partial incombustibility of the wood, which resists flame very well, but may be made to burn by continued great heat.

(314) H. W., Boston, Mass., writes: My engine is 4"×4" and pounds badly. I have examined all bearings and moving parts, and find them right. I think now the trouble is in the valve. Following are dimensions of seat and valve: Width of steam ports 7-16", width of bridges 5-16", width of exhaust port ⅝", length of ports 1⅜". The valve is 2 7-16" long, with exhaust cavity 1" wide, travel of valve 1¼". This gives inside lap nearly equal to outside. I figure that cut-off takes place at about ¾ stroke, and the exhaust must close at nearly the same time. It, therefore, seems to me that the cause of the pounding is cushioning too early, thereby decreasing the momentum. Am I right? *A.*—The cut-off will be at about ⅞ stroke, and the exhaust closure at 9-10 (average of both ends). This would not give but little compression, not so much as is generally found advisable for quick running engines. If your engine runs 200 or more we do not think its running is injuriously affected by compression. Your valve and seat are not well proportioned. When the valve is at full travel in one direction it nearly closes the exhaust. For that reason, and because there is not much exhaust lead, we should cut out the cavity in the valve 3-32" on each side, then try the experiment of changing the lead, giving more or less if it improves the running.

(315) W. P., Jersey City, N. J., asks: 1. What would you advise a machine apprentice to study so as to be capable of passing examination as marine engineer on an ocean going steamship? *A.*—Everything you can find relating to boiler and engine construction and management. Go into a book store where such works are sold, and find some that suit your taste. 2. What is meant by a foot ton? *A.*—A foot ton is the equivalent of lifting one ton to a height of one foot.

(316) J. A., Albany, N. Y., asks: How many 3" tubes is it customary to put in a 60" boiler? *A.*—Practice varies. Generally from 70 to 80, sometimes less, sometimes more.

(317) L. B., Indianapolis, Ind., asks: What is the weight of a cubic foot of cast-iron? *A.*—It varies considerably. A fair average is 450 lbs.

# BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*


Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Korting Exhaust Steam Condenser. Send for descriptive catalogue K. A. Aller, 109 Liberty st., N.Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Veneer machines, with latest improvements, Farrel F'dy & Mach. Co., Ansonia, Ct. Send for circular.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Aug. 21, p. 13. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Governors, Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

"Hints to Steam Users, Engineers and Firemen." A 100-page book on care of steam boilers; just issued; containing useful rules, tables, etc; a valuable book for engineers; sent on receipt of 25 cts. in stamps. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Wanted—Numbers 1, 2 and 4 of volume IV., 1881; must be in excellent condition for binding, if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.


# MANUFACTURES

C. F. Bruce, Medfield, Mass., will build a new boiler house.

James Donovan, Lumsey, Mass., will build a road-cart factory.

Horton & Shoup will build a blacksmith's shop at Blakeslee, Ohio.

Small, Gould & Co. will build a new brick paper mill at Baldwinsville, Mass.

The Flint & Walling Mfg. Co., Kendallville, Ky., are building a new foundry.

A new needle factory will be built by the Franklin (N. H.) Needle Co.

The Elba Iron Works, Pittsburgh, Pa., recently burned, will be rebuilt.

John Bosl will build a brick blacksmith's shop at Waverly Mills, Minn.

Baldwin & Lamkin, will build an addition to their shoe factory at Milford, Conn.

A clay shingle factory is to be built by Crane & Co., Covington, Ind.

W. F. Martham, Plymouth, Mich., will build a large planing mill at that place.

The C. & W. M. Railroad will build a $15,000 round-house at Grand Rapids, Mich.

The Iowa Barb Wire Co., South Easton, Pa., will remove their works to Allentown, Pa.

The Newark Filtering Co has opened offices in the Tribune Building, New York City.

The Johnston Chair Company, 237 N. Green st., Chicago, Ill., will build a $5,000 engine house.

The Singer & Talcott Stone Company will build a new engine house at 339 Ress street, Chicago, Ill.

The Arlington Mills, Lawrence, Mass., are again enlarging by the addition of a building 100x200 ft.

The L. L. Brown Paper Co., Adams, Mass., will enlarge their paper mill during the coming season.

A five-story bicycle factory will be built at 228-30 Franklin street, Chicago, Ill., by R. P. Gormully.

Merwin McKaig, Cumberland, Md., intends to move his foundry and machine shops to Hyrdman, Pa.

The city of Wilkesbarre, Pa., has closed a contract for a central steam heating plant on the Holly system.

The Newlin Machine Company, Philadelphia, Pa., intend to build a new brick and stone machine shop.

The machinery for the new steel casting plant at Crown Point, Ind., is rapidly being placed in position.

The Hackett & Rice Iron Fence Company, of Atlanta, Ga., will establish a wrought-iron fence factory.

James Ferguson will begin the manufacture of his patent locomotive slide-valve at Bridgewater, Mass.

The Chester Paper Company, Huntington, Mass., will make extensive repairs to their mill and machinery

The Hampden Watch Co., Springfield, Mass., are contemplating the erection of a new main building for their factory.

A large wagon factory will be built by the Standard Wagon Works Company, Cincinnati, at Carthage, Ohio.

A steam shirt factory will be started by C. F. Crosby, Cambridge, N. Y. The factory will employ 100 hands.

W. R. Dougherty, 1419 Sansom street, will build a factory, boiler and engine house on Second, above Somerset street, Phila., Pa.

A three-story manufacturing building will be built on Vale, near Thornton street, Boston, Mass., by the Dennison Mfg. Co.

Mill No. 2 of the Indian Orchard Co. (Me.), which was recently destroyed by fire, will be immediately rebuilt on a larger scale than before.

Palmers & DeMooy, Cleveland, Ohio, will build a foundry to occupy the entire space between Leonard, Minter, German and Fall streets.

The National Needle Company, Springfield, Mass., will build an addition to their works, which is intended to form the main building when completed.

The Adams Chewing Gum Factory, to be built on Sands street, Brooklyn, N. Y., will cost $65,000. Charles D. Marvin, 45 Exchange Place, New York, is architect.

It is stated that as soon as a standard is agreed upon, work will be begun on 50 locomotives for the New York, Lake Erie and Western Railroad. They will probably be hard coal burners.

It is stated that Lockwood, Greene & Co., Providence, R. I., are making plans for the steam part of the new manufactory to be located in Newark, N. J., by Michael Naim & Co, of Scotland.

A 1,500-ton steamer will be built for the Maine Steamship Company by the New England Shipbuilding Company, Bath, *Me.*, who will also build the 1,600 horse-power compound engines.

The Brooks Locomotive Works, in Dunkirk, N.Y., have taken a contract for 20 locomotives for the Chicago, Kansas & Nebraska Road, the Rock Island's new extension into Kansas.

Dando & Cleve, Pittston, Pa., have made arrangements to manufacture the Nicholson expanding lathe mandrel, heretofore put on the market by the inventor, W. H. Nicholson, of Wilkesbarre.

The Wainwright Mfg. Co., 65 Oliver street, Boston, and 93 Liberty street, New York, are building, a 4-story addition to their factory, whereby they can increase their manufacturing facilities three or four times.

The Warren Mfg. Co., Warren, R. I., are building additions to increase the capacity of their mills one-third, and Lockwood, Greene & Co., Providence, are making plans for a complete revision of the steam plant of the above mills.

Frick Company, engineers, Waynesboro, Pa., have issued a 40-page catalogue of the "Eclipse" refrigerating machinery manufactured at their works. It contains valuable information in regard to artificial refrigeration.

The Vulcan Iron Works, Wilkesbarre, Pa., are building a pair of hoisting engines for the H. C. Frick Coke Co., with cylinders 30x48 inches, and wrought-iron shaft 16 inches diameter. The bearings for shaft are 14x28 inches. Conical drums are 10x13½ feet. Bed-plate is Corliss pattern.

The Hoggson & Pettis Mfg. Co., New Haven, Conn., send us a 72-page pamphlet circular issued by them describing the Sweetland chuck, of which they are now the manufacturers, together with a line of small cutting dies, rubber manufacturers' supplies, steel stamps and similar specialties.

If the current newspaper reports are true regarding extensive purchases of real estate at Greenville, N. J., in the interest of the Baltimore & Ohio Railroad, and for the purpose of affording that corporation terminal facilities on New York Bay, probably provision for railroad shops will also be found included in the company's plans.

W. P. Davis, North Bloomfield, N. Y., writes us: Business is much better with us than it was two months ago. We are again getting orders from the West. We are having more inquiries than for some months previous, and those we are getting are from parties who wish to buy. Everything looks favorable for a good fall trade.

It has been decided to inaugurate on June 1, 1887, in Lima, Peru, in the buildings of the Lima Exposition, under the auspices of the Government, a mineral exposition. It is intended to exhibit samples of the rich and various minerals and ores of the country, properly classified, as well as machinery and apparatus used for the exploration of mines and in metallurgical operations.

The Union Stone Co. has opened a branch office at 36 John street, New York, where they will carry a stock of the goods manufactured and sold. These will consist of wheels and emery-wheel machinery, together with all the materials and manufactured articles used for abrading and polishing purposes; also plating materials of all kinds, glue and similar supplies. George A. Walker is manager.

Business is good with the Tanite Company, of Stroudsburg, Pa., manufacturers of emery-wheels and grinding machinery. Originally the shops of this company were located three miles from the village on account of the water power, but two steam engines are now relied upon as auxiliary. The company has just shipped 17¾ tons of "Tanite" wheels to Paris and Liverpool. About 10 men are employed in the works.

The Wisconsin Central Company has purchased a large tract of land in Waukesha, near the White Rock Springs, and will build their new car shops there. The buildings will be of brick and stone, and will consist of a locomotive repair shop, a car repair shop, a foundry, tin shop, boiler shop, copper shop, paint shop, kiln for drying lumber, and a large round-house. It is expected that 300 men will be employed in the works.

The Mechanical Orguinette Co., whose principal factory is at Greenpoint, L. I., and which has branch factories at New York, Worcester and other places, with stores in New York, Chicago and San Francisco, will unite their manufacturing at Meriden, Conn. They have leased the Meriden Flint Glass Co.'s factory, except the furnace rooms, which will not be disturbed, as they in all probability will be needed for glass making in the near future. The factory will be connected with the Wilcox & White Organ Works by a bridge, to better facilitate shipping.

It is said that works for the Anglo-Pacific Steel Co. is soon to be built at San Francisco, Cal. A wharf 62 feet broad will extend 400 feet into the bay. Cranes, furnaces, steam hammers, forges, and all the other apparatus needed for a first-class plant are to be provided, and the works is to cover the widest range, from horseshoe nails to armor plates and crank-shafts for ocean steamers. Until the iron required is obtainable in California, material will be imported from England. The steel is to be known as "bonanza steel.—*Engineering and Mining Journal.*

W. H. Parsons, of New York, who is already interested in paper mills at Topsham, Me., is to come to this State and engage in the manufacture of pulp by the German "bisulphite" process. He will build a dam and sulphite mill at Lisbon Falls, on the Androscoggin, and also erect a paper mill at the same place. Operations will commence very soon. Mr. Parsons is, we believe, the first in this country to engage in the manufacture of sulphite, which is a product invented and patented in Germany. He is confident of its future, however, as he is quoted as saying: "I know the figure at which the fiber can be produced, and I am satisfied that it is a profitable business, and the best proof that I can offer is that I am willing to invest a large sum of money in a mill for the production of sulphite."—*Industrial Journal.*

The manufacturing village of Jewett City, on the Quinebaug river, about ten miles north of Norwich, Conn., is, in ordinary times, one of the busiest towns in the whole State. At present a heavy burden is resting upon its inhabitants in repairing the damage done by the severe freshet of February last, when the Ashland reservoir gave way and swept away dams, bridges and houses from the break clear through its course, until the Pachaug river flows into the Qu nebaug. The Slater mills suffered the most, and but for the breaking away of their dam, the whole of their large mill would have been destroyed. As it was, the machine shop and some other parts of the mill were carried away. The work of repair has been in active progress since the time of the injury, and is nearing completion. The Slater dam is already completed, and a fine iron bridge spans the river below it, in place of the wooden structure which was swept away. The Ashland dam is not yet completed, but the work is in active progress. A coffer dam has been put in, and about one-third of the machinery in the new mill is run by the water thus obtained. The company are running their old mill by steam. Some of the machinery in the Slater mills is enabled to run by the small amount of water which passes through the Ashland wheel on the same stream a half mile above, and the whole establishment will be in operation when the Ashland dam is completed. The railroad company has experienced great difficulty in putting in a new bridge in place of the old one swept away. Piles were driven to form a firm foundation for the new structure, but it seemed difficult to reach a hard bottom. Two or three different parties have undertaken the job and it is but just accomplished. The bridge is completed and will soon be placed upon its foundation. The East Berlin Bridge Company have already put in two iron bridges in town, and have one other yet to put in. They have also put in three in the neighboring town of Plainfield. —*Commercial Bulletin.*

## Machinists' Supplies and Iron.

NEW YORK, Aug. 12, 1886.

The market continues quiet and no new feature has developed, either in manufactures or in trade.

Iron—In American pig Standard brands rule steady with but little demand, except from conservative consumers; still the market is very steady. We quote Standard Lehigh and North River brands $18 to $18.50 for No. 1 X Foundry; $17 to $17.50 for No. 2, and $16 to $16.50 for Grey Forge.

Scotch Pig—Business is composed mostly of small sales from stores, and the demand remains light.

Lead—4.75c. to 4.80c.

Antimony—Hallett's, 7¼c.; Cookson's, 9c.

Copper—10.10c. to 10.50c.; Baltimore, 9⅝c.

Spelter—Refined, 5¾c.

Tin—Banca, 22½c.; Straits and Malacca, 21.95c.

## ✲WANTED✲

*"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

An experienced draftsman on steam engines and general machinery would like to change position. Y. X., AM. MACHINIST.

A thorough machinist and draftsman desires to take position in machine works where a right-hand man is required. B., AM. MACHINIST.

Wanted—By practical mechanic, position as foreman; 15 years experience as manager; strictly temperate and industrious. Address O. M., AM. MACH.

Wanted—Supt. of machine works wishes to re-engage; steam and heavy work; references. J.J., Care AM. MACHINIST.

Mechanical engineer, thoroughly posted in Southern machinery trade, desires position as agent or salesman for responsible house. Address L., AM. MACHINIST.

Wanted—Foreman in a small hardware factory; one who thoroughly understands the manufacturing of small tools. Address, stating age, experience and wages expected, Hardware, AM. MACHINIST.

Traveling salesmen handling engineers' and mill supplies, can make desirable arrangements to sell "Eureka" packing. Special pocket-book of samples furnished. Hine & Robertson, 12 Cortlandt st., N.Y.

Wanted—Traveling salesmen selling to steam users, machinery and mill supply houses and the hardware trade, to write for my terms and commission on some fast-selling articles. Address J. L. K., care AM. MACHINIST.

Wanted—A clerical position in a Western city, by a young man of ability and experience, in a gas and steam fitting mfg. Co.; best of reference given. Address H. H. H., care of Letter Carrier No. 303, South Boston, Mass.

Wanted—At once, five good men to work on our stitching and tying machines; also two who can do adjusting; I want careful, accurate workmen, who are steady and reliable, and I don't want any other kind. Sterling Elliott, Newton, Mass.

Wanted—By a machinery manufactory, an experienced outside man and salesman; a machinist and one having some capital preferred. Address, giving age, experience, references, Machinery, care Letter Carrier 119, Chicago, Ill.

Wanted—A first-class working foreman in shop in N. Y. City; 15 men; must be first-class workman on interchangeable machinery; able to handle work and men, and must be quick; build light machinery and tools. Address, stating experience, etc., Box 28, AM. MACHINIST.

Wanted—Foundry foreman; one of experience in large engine work; must be thoroughly competent in the work and the handling of men; must be strictly temperate; to the right man steady work with fair salary will be given. Address, with references and experience, H. O. R. Co., AM. MACHINIST.

## ✢ MISCELLANEOUS WANTS. ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Steel stamps, stencils, burning brands, and brass checks. T. M. Parker, Hartford, Conn.

Light mach'y of all kinds built at short notice. Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Want to buy second-hand iron planer; must be cheap and good. Wm. Hansell, Nevada, Iowa.

Send for estimates of high-speed compound enginss for stationary and marine service. Crist Engine Works, 140 Baxter street, N. Y.

John Lamberty, mfr. telegraph and electrical instruments, experimental machs, models; fine gear cutting a specialty. 35 S. 5th st., Br'kl'n, E.D., N.Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

To Rent—Desirable space, 8x10, in light, well-fitted office; heart of machinery trade; $12 per month. Hine & Robertson, 12 Cortlandt st., N. Y.

For Sale—A new 20-H.P. automatic cut-off, high-speed engine; shipping point, Chicago, Ill. E. F. Wilson, Johnson City, Tenn.

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*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

Experimental and new machinery for special purposes built under contract from specifications and inventors designs; ample shop and shipping facilities; correspondence solicited. Cohoes Iron Foundry and Machine Co., Cohoes, N.Y.

Wanted—Price, description, and cut of slotter about 12" stroke, to slot to center of 48" circle, with automatic feed in all directions; name terms and earliest delivery. Address Columbus Iron Works Co., Columbus, Ga.

For Sale—A well established foundry and machine shop, including lots, buildings, machinery, patterns, and stock on hand, situated in Logan, Hocking Co., Ohio; will sell on easy and satisfactory terms; reason for selling—old age and ill health. Apply to R. Belt, Logan, Ohio.

Wanted—A second-hand engine lathe, of Bridgeport Tool Co.'s or equally good make, 8" or 10" swing, 5' or 6' bed, hollow spindle, with 6" universal chuck; want above in good condition, and for which we will pay a reasonable price. The John T. Noye Mfg. Co., Buffalo, N. Y.

M. Martin, manufacturer. P. O. Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

Alfred Dolge (Felt. Dept.), Dolgeville, N. Y., writes to T. R. Almond, 83 and 85 Washington st., Brooklyn, N. Y. "Your Almond Couplings are doing splendid work. I have used two for months, to the satisfaction of every one in my mills. Am putting up the third one now, and certainly give them the preference over beveled gears."


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Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

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50 Per Cent of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the Improved taper pipe, and other attachments. Sold by the trade. Send for circular.

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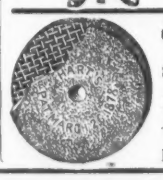

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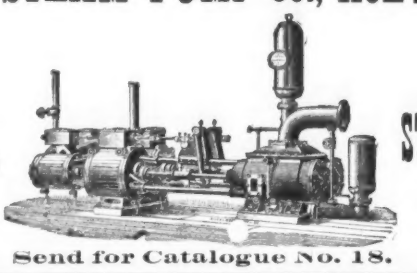

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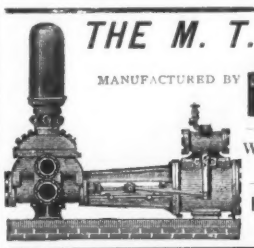

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The only Reamer that will keep its size, and always make a straight hole. As easily sharpened as a Lathe Tool.
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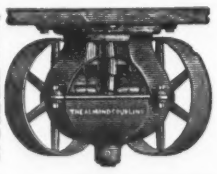

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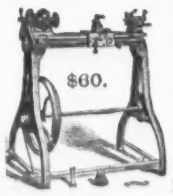

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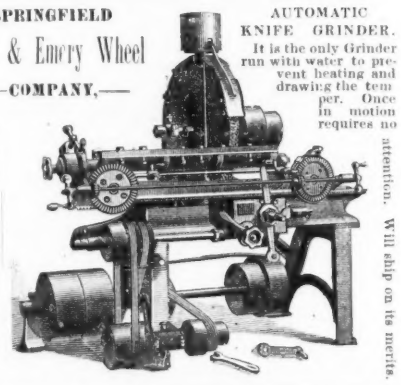

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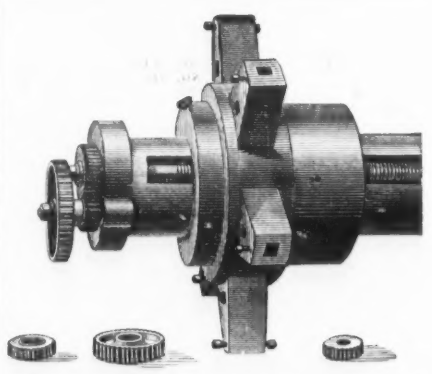

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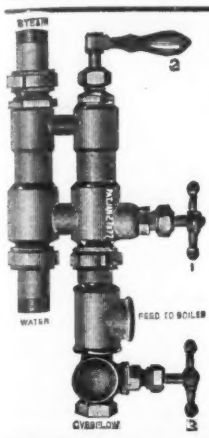


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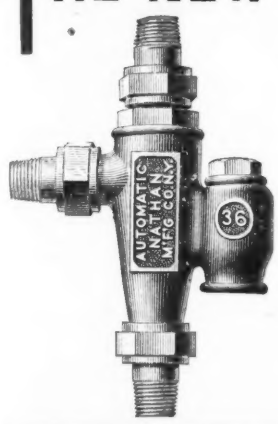


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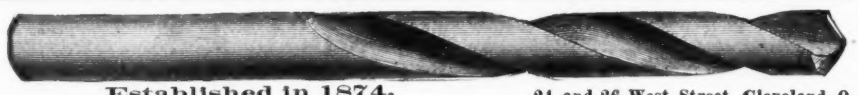

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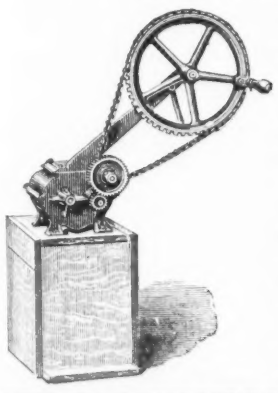

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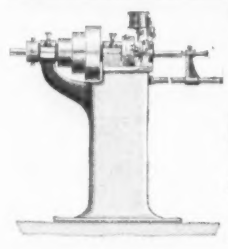

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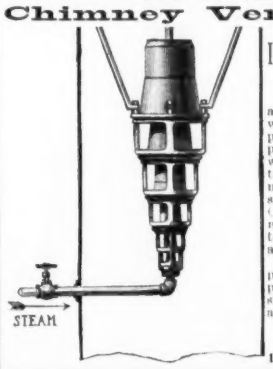


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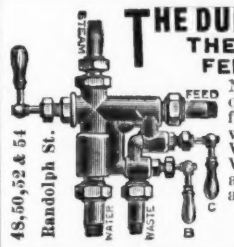


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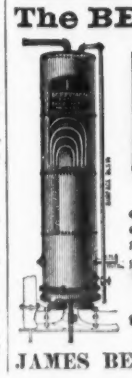

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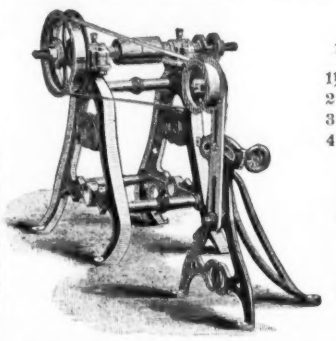

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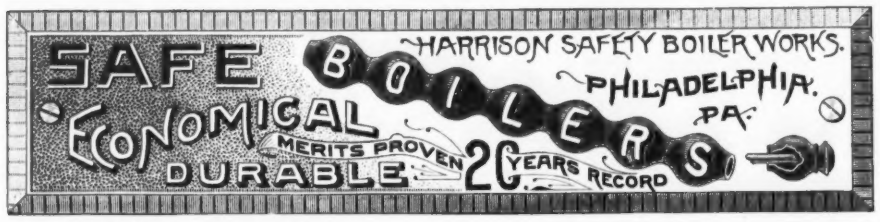


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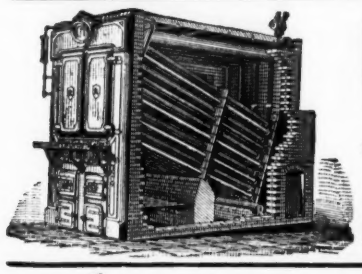

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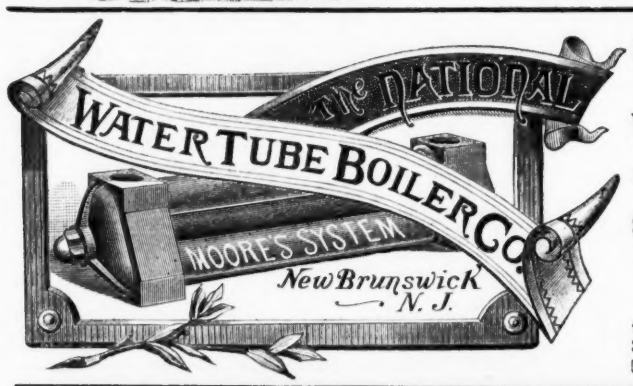


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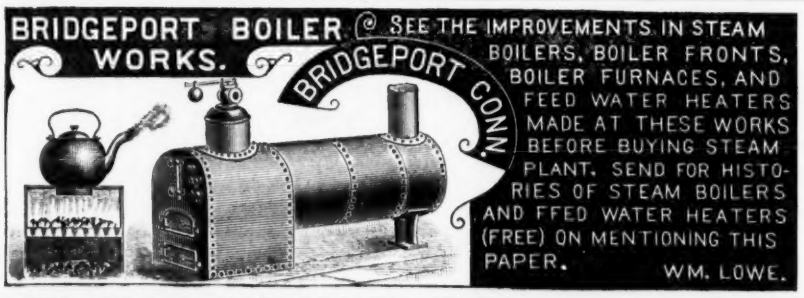
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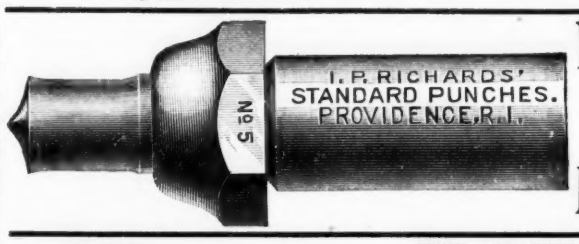


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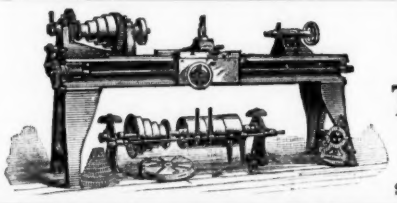

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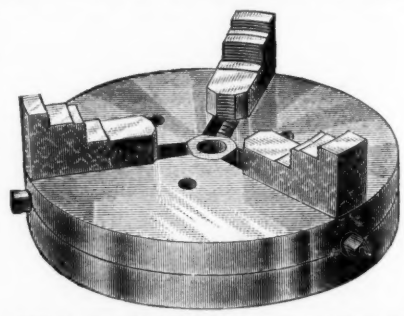
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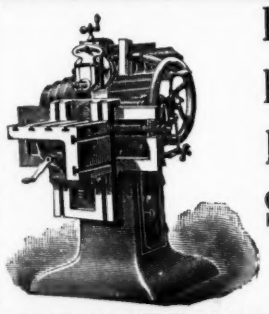
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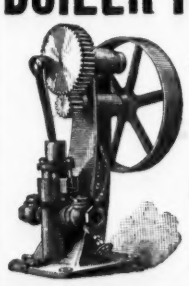
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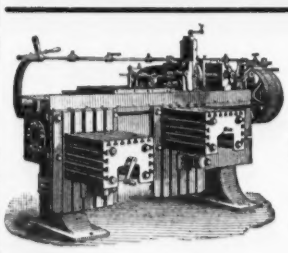
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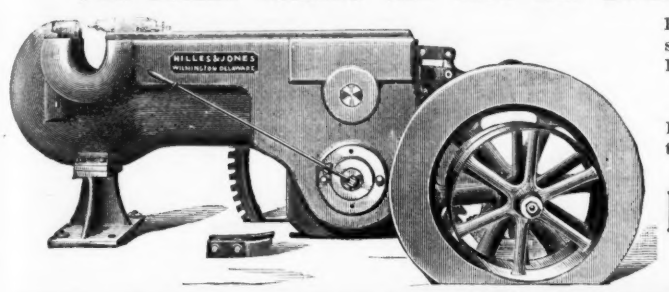


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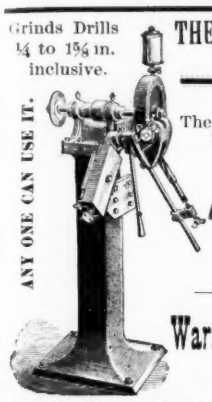

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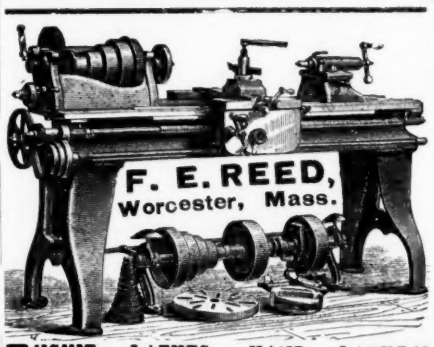


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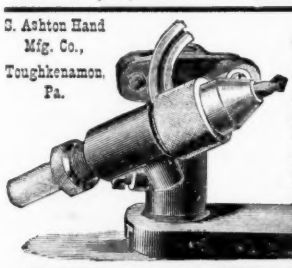

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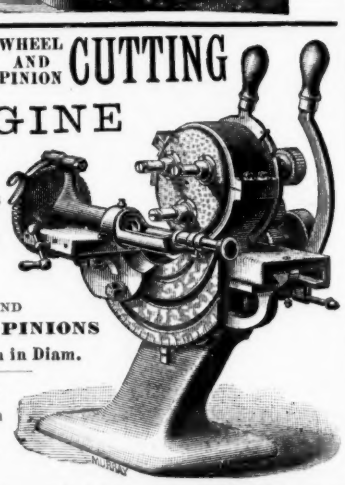

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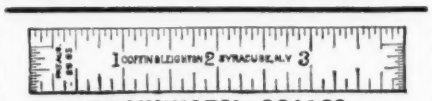


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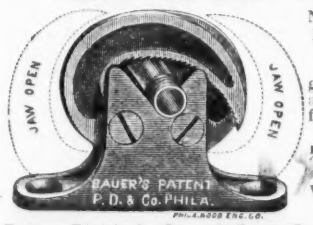


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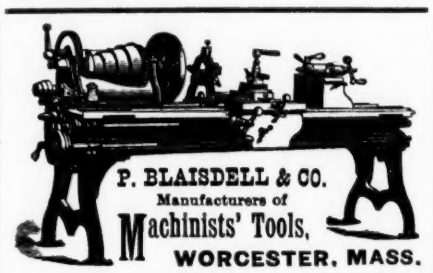

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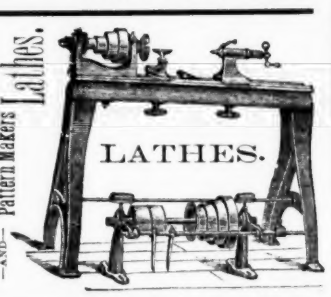


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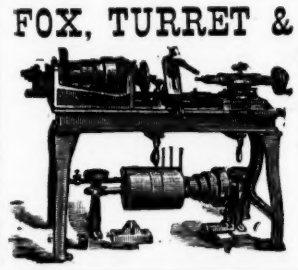

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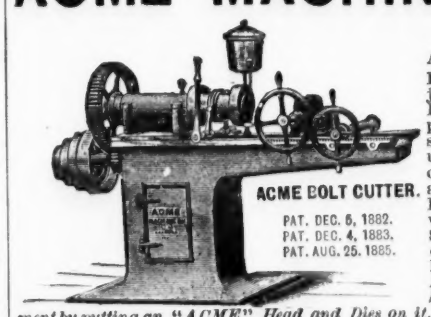


**Advantages of the "Acme" Bolt Cutter:** Large bearing on top of Dies by using a Cap. Fine adjustment by differential screw. Positive Toggle Lock Die-ring connected to Barrel. Positive Motion. Every part exposed to view, it cannot clog with chips or scale. Quickness of changing Dies (in less than a minute). No springs used. Index on Head so a fit can be cut at once. Cheapness of Dies. Advantage of Plain and not the disadvantage of Case Dies. Reversible Dies. Even number of Dies and ahead of center. All wearing parts are tempered Steel, made to Jigs and Standard Gauges, and are interchangeable. Dies cut in one Head will fit any other, and where more than one Head is used this is a very vital point. *The ACME Head can be put on almost any Bolt Cutters, and parties having other make of machines will find a great improvement by putting an "ACME" Head and Dies on it.*

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"Mitis" Castings retain in every respect all the valuable qualities of the wrought iron and steel (scrap) from which they are made. Do not require annealing. Can be welded and worked under the hammer as well as the raw material.

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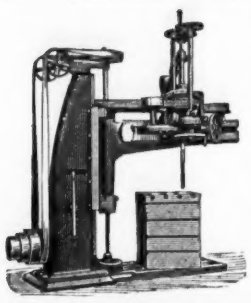

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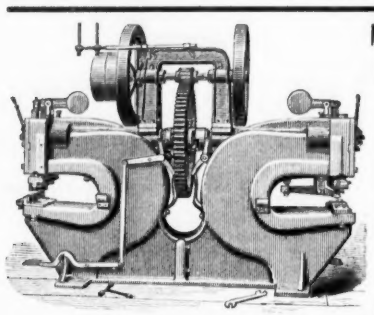

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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

**Punches and Shears.**

Over 300 Sizes.

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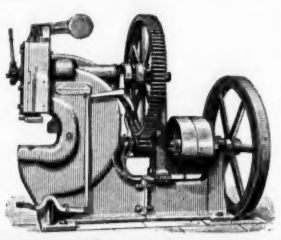

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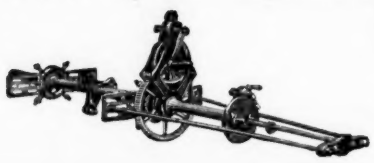
## Patent "Special" Improved Locomotive Cylinder Boring Machine



Will bore out Locomotive Cylinders IN THEIR PLACES by removing one or both heads and piston, THE END THRUST IS ALWAYS IN EXACT LINE WITH BAR.

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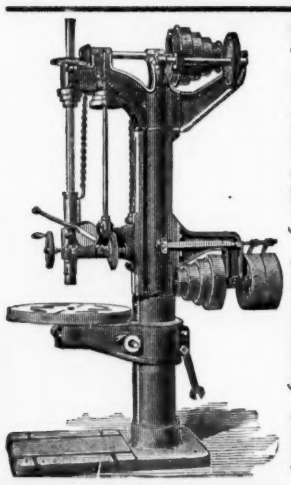

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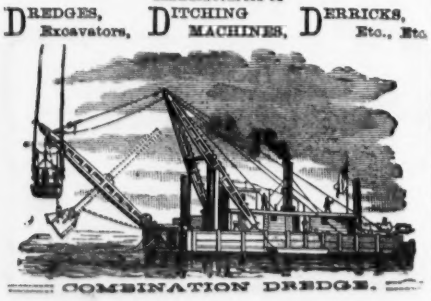

COMBINATION DREDGE.

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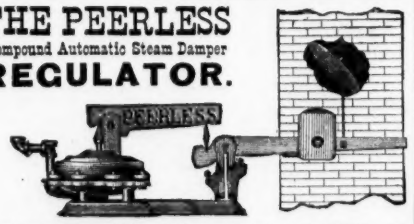
Compound Automatic Steam Damper

**REGULATOR.**

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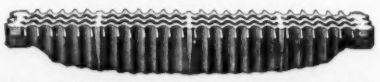

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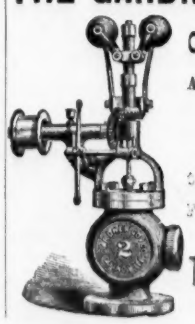

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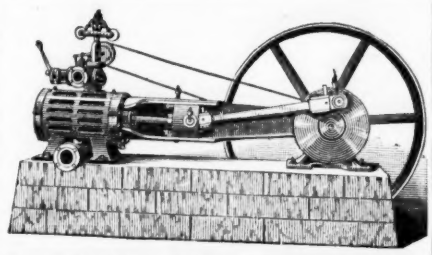

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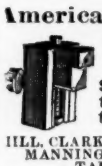

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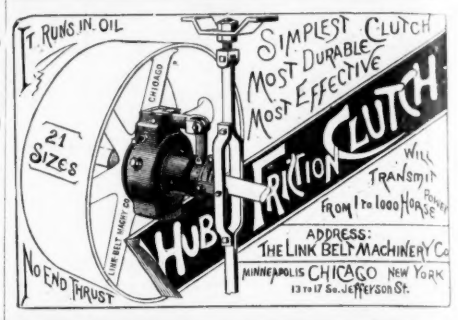


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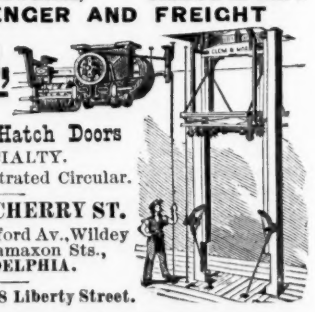

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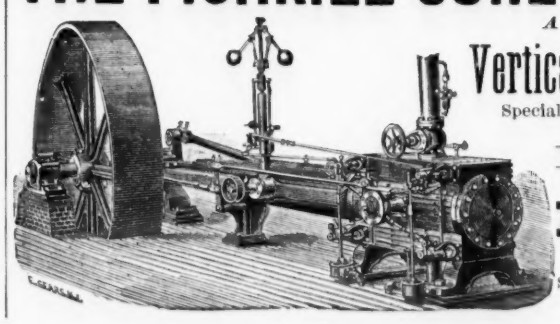
*A FULL LINE OF SIZES.*



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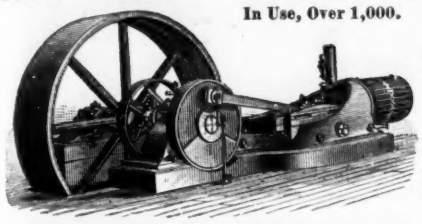

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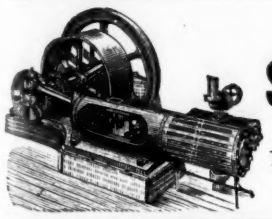

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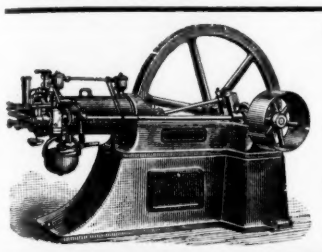

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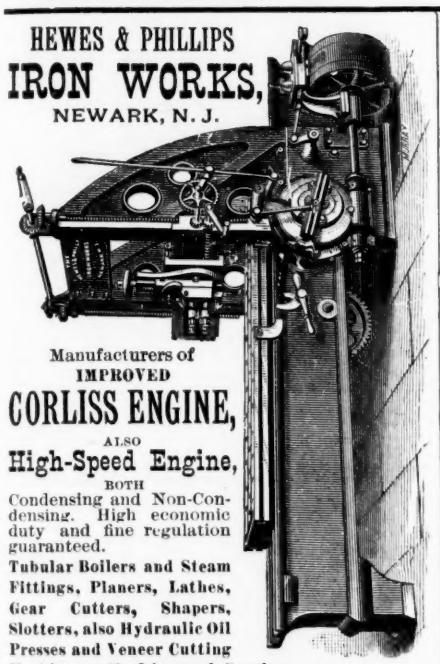

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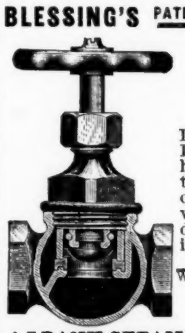

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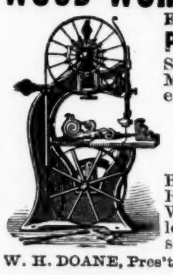

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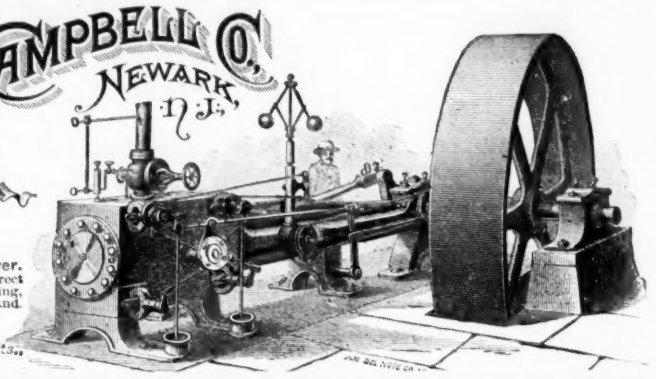

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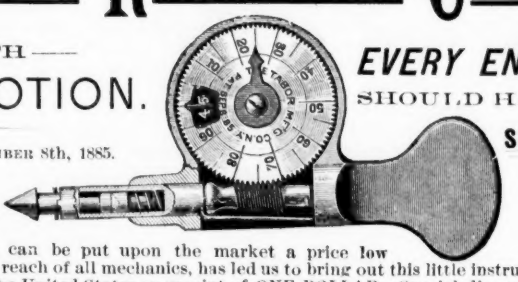

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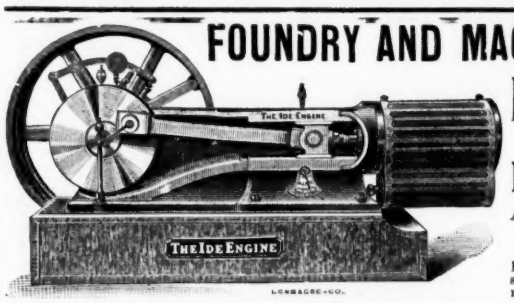


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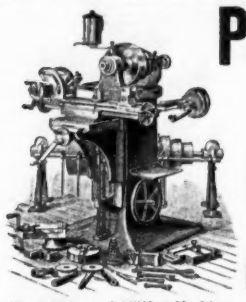

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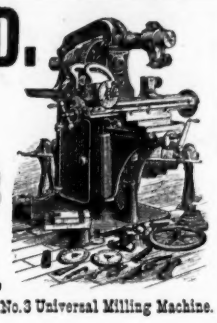

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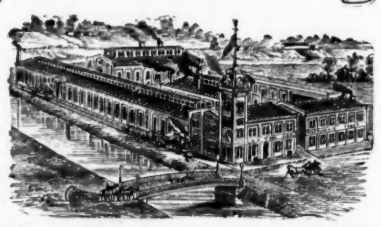

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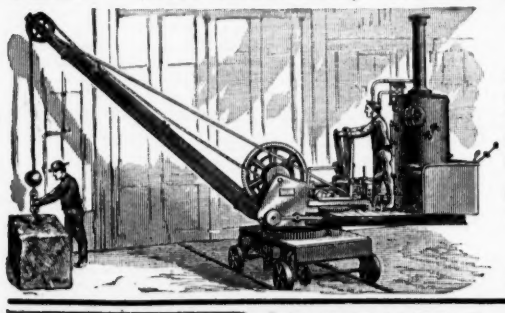

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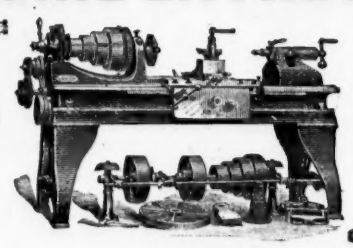

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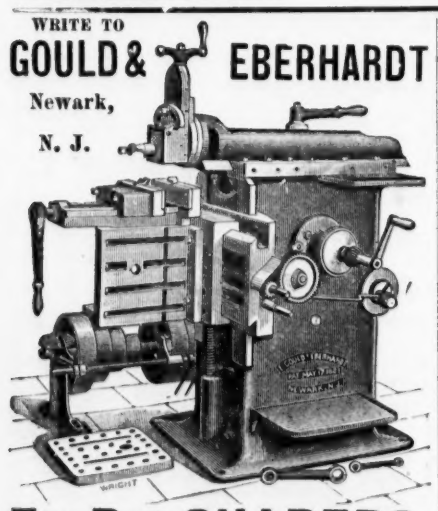

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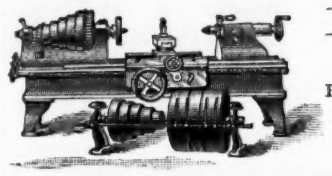

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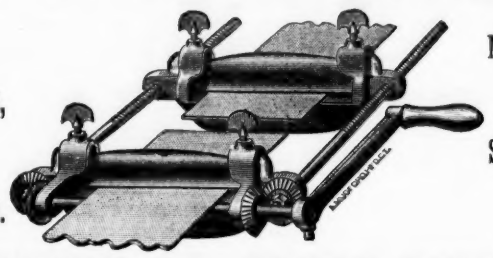

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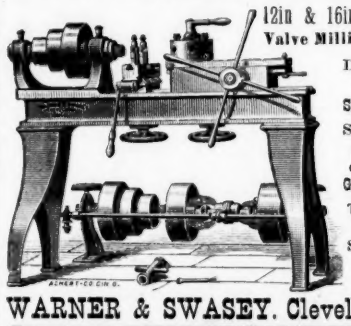

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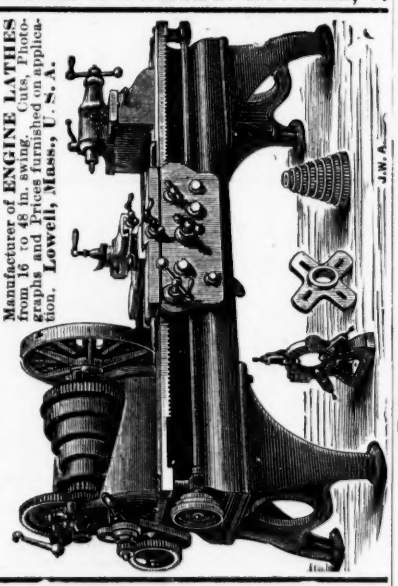

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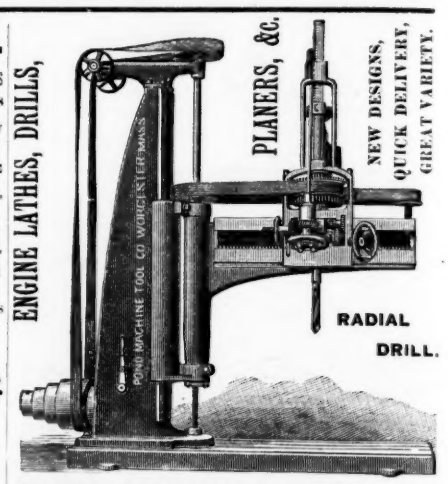

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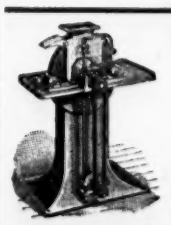

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